IBS
Precision Engineering

USER'S
MANUAL

Machine Tool Console

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CONTENTS

1 Introduction

Welcome to the Machine Tool Console manual. IBS Precision Engineering offers a family of solutions for quality control of machine tool geometrical accuracy. This family includes the four applications:

1. Position Inspector;
2. Position Analyzer;
3. Rotary Inspector;
4. Rotary Analyzer.

Users may apply up to four of these applications at any time on their machine tools. The Machine Tool Console acts as a central portal for these applications providing the following key functions:

- Communication between the Trinity measuring head and the software application is established by the Machine Tool Console;
- Selection of measuring heads (supervisor level only).

For the Position Inspector only the following is also managed through the Machine Tool Console:

- Definition of the following within a local database:
  - Machines;
    - Measurements;
    - Tolerance levels;
- Vibration threshold levels.

Supervisor level only

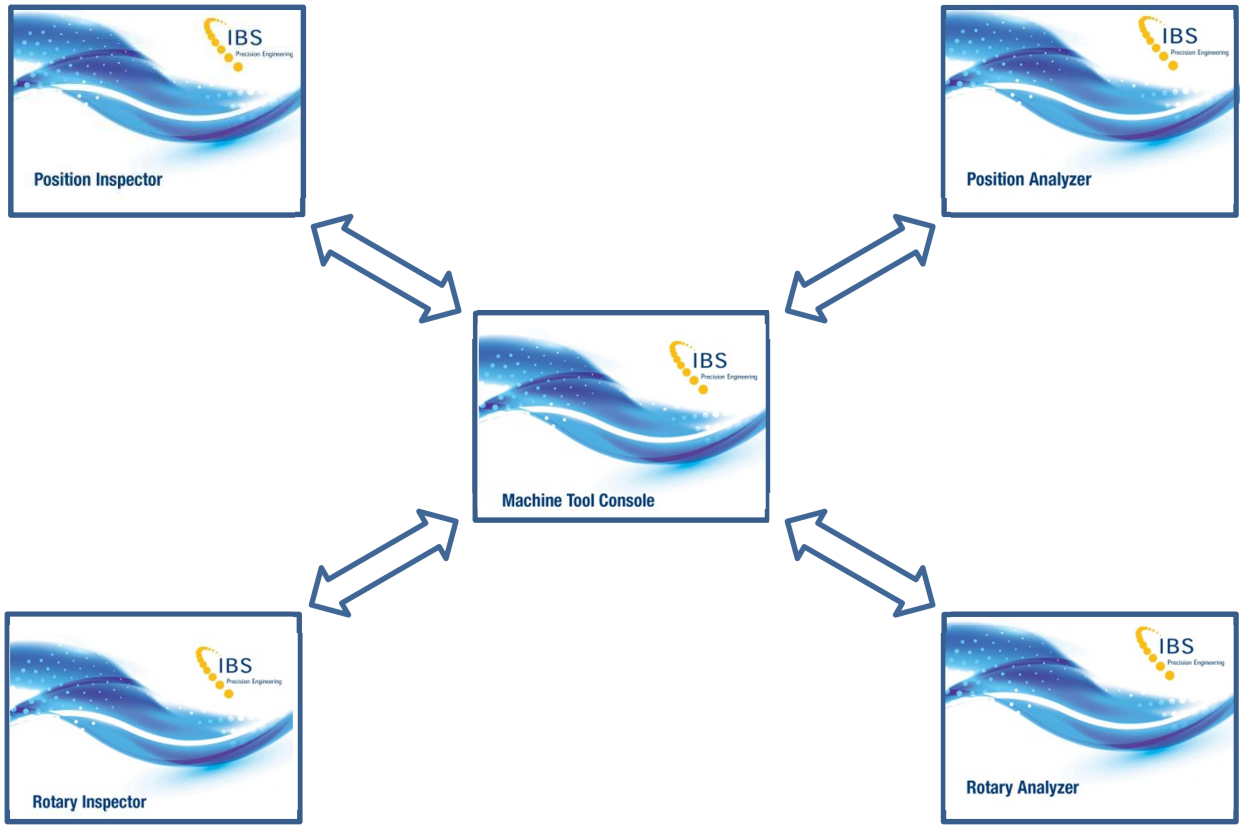


Figure 1-1: Software overview

INSPECTOR systems are typically used for **production monitoring**. Machine-integrated and workshop robust, they provide rapid qualification of cutting position, rotary table characteristics or spindle behaviour. Simple go/no-go testing supports machine management and reduces out-of-tolerance products; data logging makes essential maintenance planning easy.

ANALYZER systems are typically for advanced users; such as machine tool builders, developers or maintenance providers. They offer fully calibrated, **in-depth measurement** and feedback capability. Machine acceptance, qualification, compensation, alignment and diagnostics are common applications.

Brief description:

The **Position Inspector** combines the Trinity probe with a set of separate master balls. These master balls are mounted or even fixed permanently to the machine's table. The position of these master balls is measured periodically (i.e. each hour) and the measured ball position is compared to the initial ball position. In this way the long term **stability of a machine tool** is monitored throughout its entire working volume.

The **Position Analyzer** combines the Trinity probe with a CMM calibrated ball beam. This ball beam is mounted parallel to a linear machine axis and the position of these balls is measured according to ISO 230-2. By comparing the measured ball positions with the calibrated ball positions three error motions of the linear axis are measured simultaneously in about 5-10 minutes:

1. **Linearity**
2. **Vertical straightness**
3. **Horizontal straightness**

This application can be considered as 3 classic laser interferometer measurements combined.

The **Rotary Inspector** uses the Trinity probe in combination with a single master ball. The displacement of the master ball is measured while the machine executes a **predefined cycle** with at least one rotary axis active. This application is of interest to check the **accuracy of five-axis machine tools with a high degree of automation**. Measurements described in ISO 10791-6 are implemented and used typically. A machine and measurement type data base is used to measure many machines with little effort.

The **Rotary Analyzer** also combines the Trinity probe with a single master ball but is typically used by high level machine operator and machine experts. Measurements can be generated and analyzed with a high degree of flexibility. Many options are implemented to be able to measure any five-axis machine tool. Often the pivot line of a rotary axis requires correction which are calculated and entered into the machine's controller. Squareness errors of a rotary axis for example are determined with the Rotary Analyzer only.

2 Software Installation

System requirements:

Operating system	: Windows 7, 32 & 64 bit; Windows 8.1, 64 bit
Memory	: 4 GB or more
Hard disk	: 180GB or more
USB ports	: 1 free port for wireless network adapter.

The software comes in one single installer which installs all parts of the system sequentially. The sequence consists of the following items:

2.1. The “Machine Tool Database”. This database contains all settings- and configuration parameters used by the “Machine Tool Console” and all applications which, in turn, are called by this Console. This database is explained in detail in appendix A.
2.2. The “Machine Tool Console”. This Console is used to select from available applications listed in 2.3. It will also setup the wireless network.
2.3. Any of the following applications:

- Position Inspector;
- Rotary Inspector;
- Position Analyzer;
- Position Analyzer;

2.4. Installer for the “NetGear A6100” network adapter driver for USB. This network adapter is used to communicate with the measuring head.
2.5. Batch file running a windows registry correction in case the software operates in a windows ‘.local’ domain.

In the following sections the installation is described in detail.

Note: Make sure you have administrative rights to perform the software installation.

The installation of the ‘Trinity’ measuring head (Trinity) and its calibration must be performed after the Machine Tool Console and its database are installed. The description of this installation is described in section 2.4.

2.1 New installation or upgrade

When installed for the first time, the system will install the database in “C:\IBSPrecisionEngineering\MachineToolDataBase”. The installer takes care of setting the read and write permissions for all users in this location.
Upgrading the Machine Tool Console from all previous versions to version 2.1.0 has only consequences for the location of the database. In the old configuration, the location of the database is in “C:\Program Files (x86)\IBS Precision Engineering\MachineToolDataBase”. The upgrade will not affect the existing database in any way. Both databases are identical. After the upgrade has been performed, the system will still point to the database in the “old” location which will function perfectly with respect to older datafiles.

2.2 Start of the installation

Running IBS_Start.exe on the application DVD which comes with the system starts the installation. The following screen appears (Figure 2-1 shows the installer for the Rotary Analyzer):

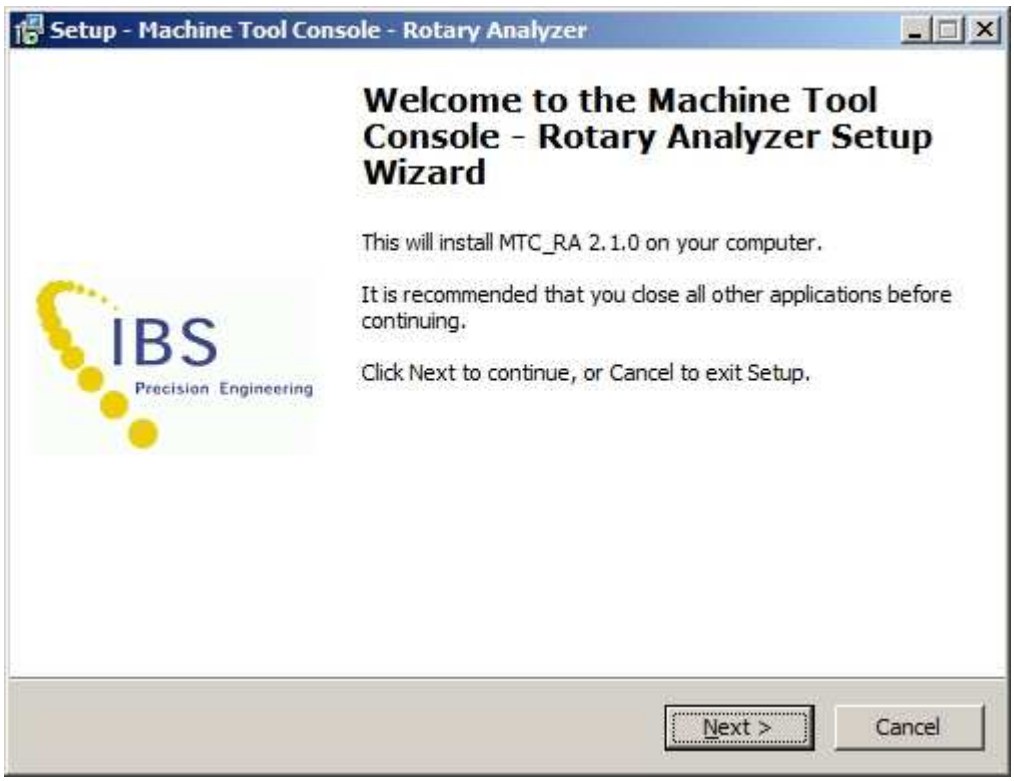


Figure 2-1: Installation startup

Click “Next”; the following screen appears:

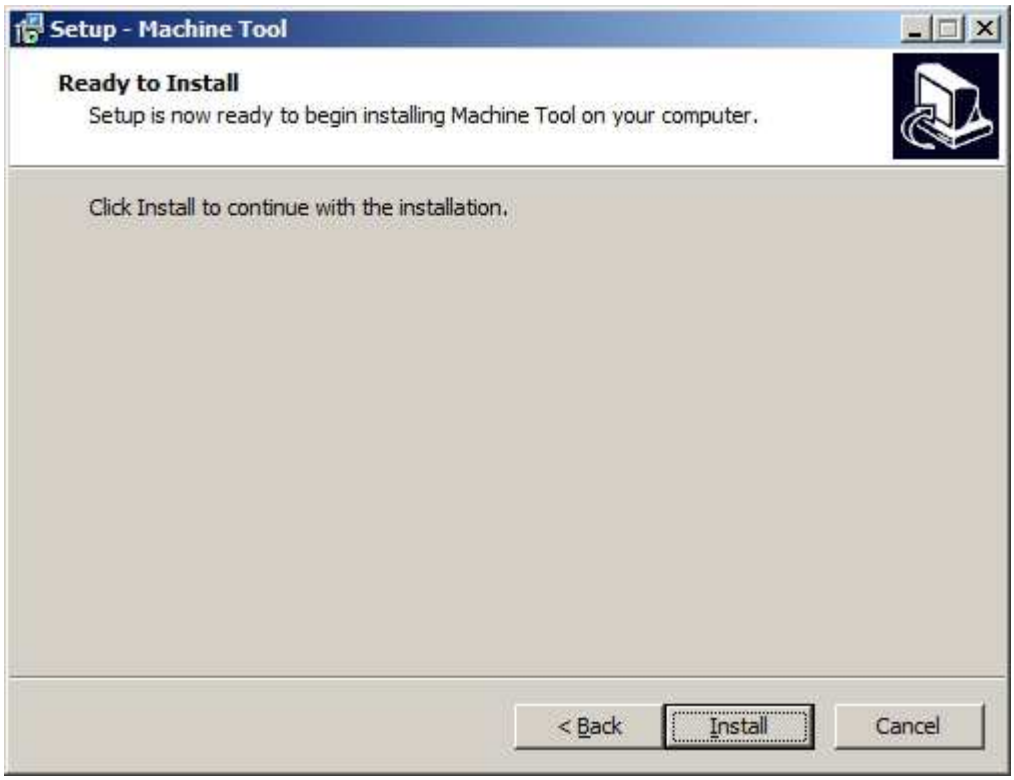


Figure 2-2: Ready to install

Clicking “Install” will copy the contents of the DVD to a local directory: “C:\MT_Install_xx” (where xx is an abbreviation of the application to be installed, for instance xx = PI = Position Inspector):

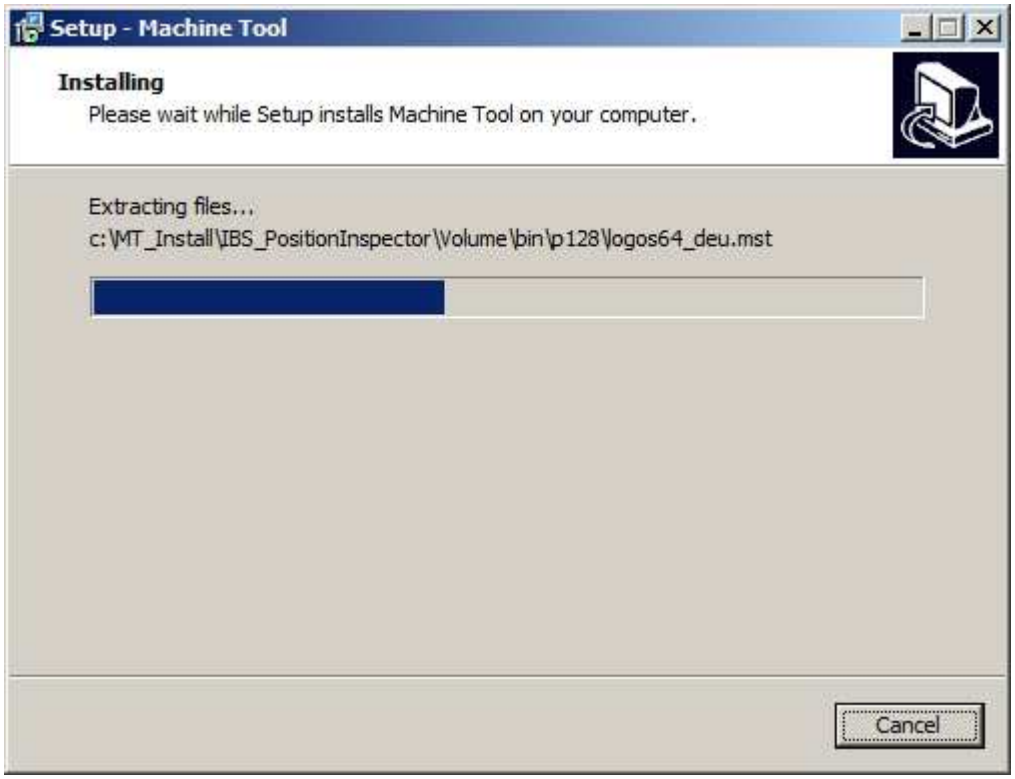


Figure 2-3: Copy DVD contents to a local directory

When copying the data to the local directory is finished, the installation of the complete package will start in ‘silent’ mode, which means that all parts of the software will be installed without any interaction of the user/operator.

The order of installation is:

1) Machine Tool Database
2) Machine Tool Console
3) Machine Tool Application (Position Inspector, Rotary Inspector, Position Analyzer or Rotary Analyzer)
4) Windows driver NetGear A6100 USB Network Adapter.
5) Adobe Acrobat PDF Reader
6) Local network domain check

2.3 Finalizing the installation

After installing all parts of the software, the final screen appears:

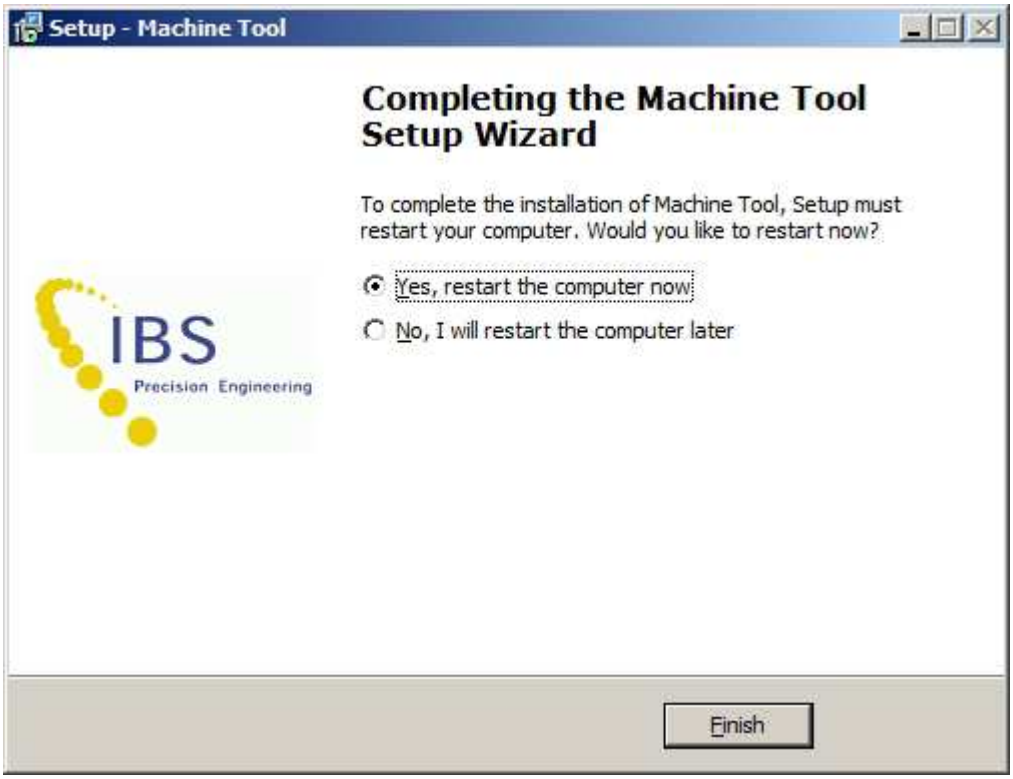


Figure 2-4: Finish installation with a system restart.

Select “Yes, restart the computer now” and click ‘Finish’ to finish the installation. After restart the ‘Machine Tool Console’ is ready for use.

2.4 Installation of the ‘Trinity’ measuring head and its calibration

To install a new ‘Trinity’ measuring head (Trinity) and its calibration, the Machine Tool Console and its database must be installed first.

Insert the DVD containing the Trinity calibration installer into the drive and run ‘Setup.bat’: this will open a command prompt and the automatic installer. Both windows will disappear when the installation of the new measuring head calibration is finished.

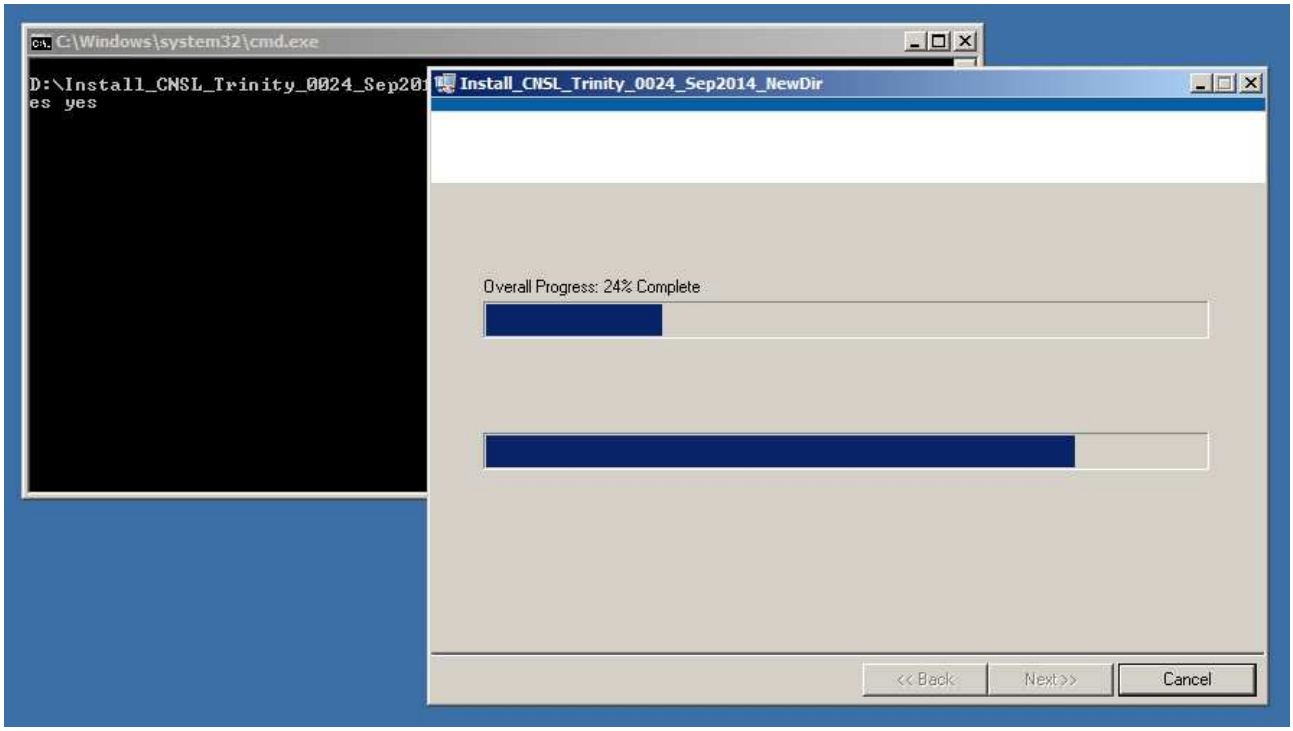


Figure 2-5 Installing new head calibration

3 Getting started

3.1 System setup

To startup the wireless network and Trinity the following steps are required:

Step 1: Before using the white D-Link Access Point Adapter, check the switch on the top (located in the red circle in Figure 3-1) is set to ‘Router AP’. Insert the Access Point Adapter into a power socket. Wait until its LED turns from red to green (this can last half to one minute);

Figure 3-1: D-Link Access Point Adapter.

Step 2: Insert the NetGear A6100 USB Network Adapter in the laptop;

Figure 3-2 NetGear USB Network Adapter

Note: When the NetGear USB Network Adapter is connected for the first time Windows will install the appropriate driver associated with it and will assign a unique name to this adapter (“Wireless Connection x”, where x is representing a number). It is required to rename the adapter to a name without spaces. A correct name would be ‘TrinityAdapter’ or ‘TrinityAdapter1’.

Step 3: Switch on the measuring head;

Figure 3-3: Location of Trinity measuring head switch.

Step 4: For convenience it is recommended to create a shortcut to the IBS_Console.exe application on the desktop. The icon of the shortcut is shown in Figure 3-4. Start the application from this shortcut.

Figure 3-4: Console startup icon.

3.2 First startup of the application

At first startup of the application the following settings may have to be made:

- Set the absolute path to the machine tool database used by the Console and the inspector/analyzer applications.
- Add the Console application as a rule to the windows firewall (even if this firewall is not used).

The above mentioned settings are stored in the Console application.

Below the issues are explained in detail:

3.2.1 Absolute path to the machine tool database

If the path to the machine tool database is not correct at start up the following screen appears:

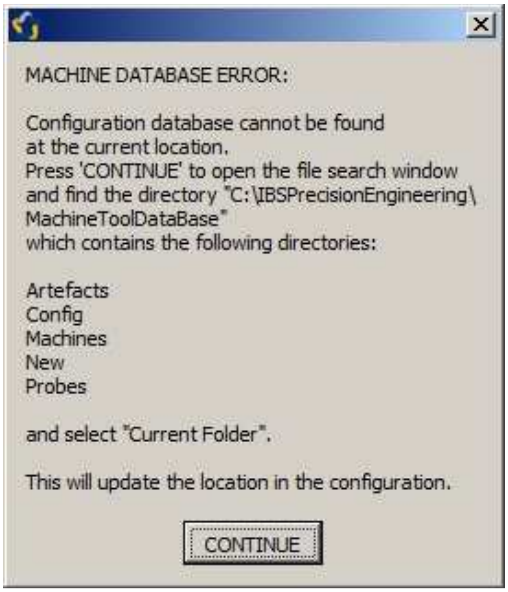


Figure 3-5: Setup correct path to database.

The application searches for the five directories: Artefacts, Config, Machines, New and Probes, which are contained in the database. To set the path to this database correctly, select 'CONTINUE'.

The following file search window appears:

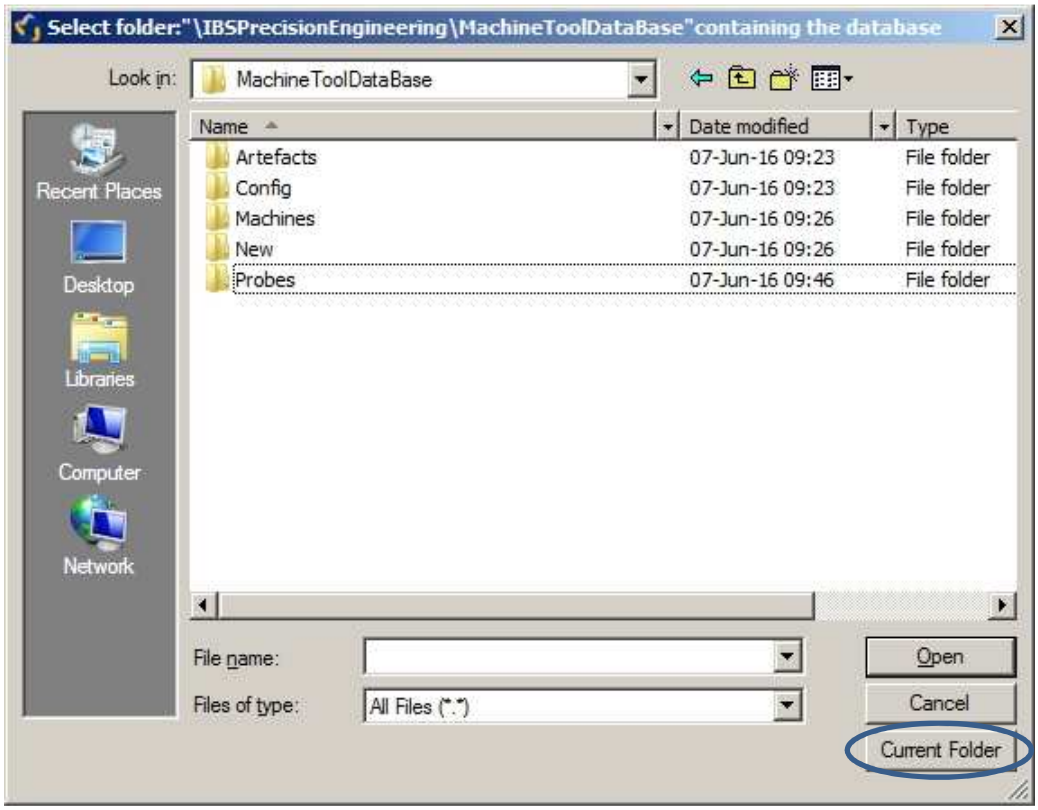


Figure 3-6: Finding the 'Machine Tool Database'.

When the location of these five directories is found and selected , press 'Current Folder'. This path is updated into the system configuration.

3.2.2 Add the Console application as a rule to the windows firewall

When the Console application sets up a wireless connection, the following screen may pop up:

Figure 3-7: Adding the Console application to the windows firewall.

Selecting ‘Allow access’ adds the application to the windows firewall and updates this information in the windows configuration permanently.

At next startup of the ‘Machine Tool Console’ these issues do not appear again.

4 Application

4.1 Startup

Each of the four Machine Tool applications can be individually purchased. Only those installed are activated in the Machine Tool Console. From this control application a start screen displays a matrix from which the activated application(s) can be selected:

- Position Inspector;
- Rotary Inspector;
- Position Analyzer;
- Rotary Analyzer.

The ‘Spindle’ applications are not described in this manual.

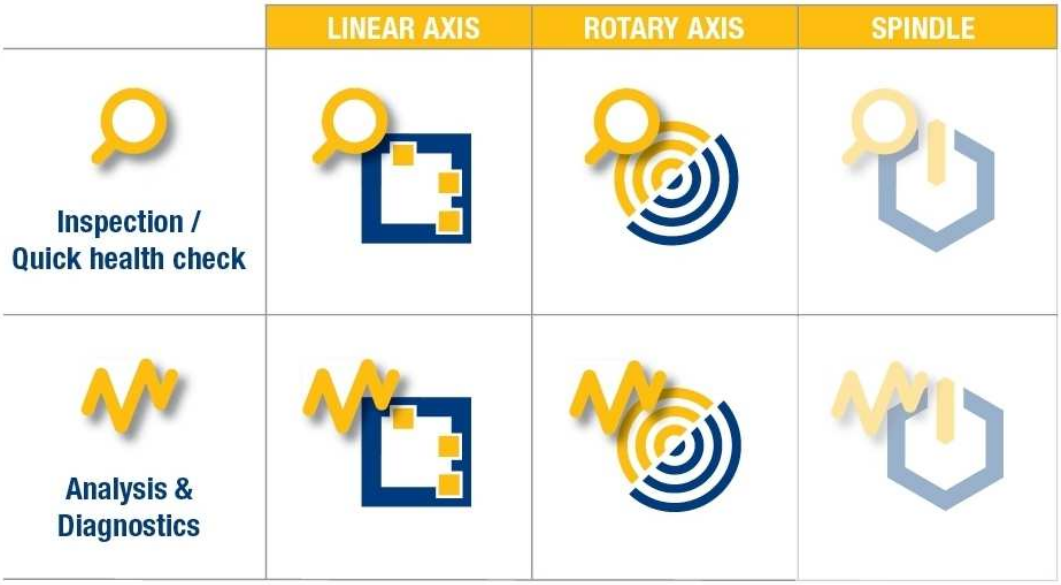


Figure 4-1: Machine Tool Console.

Each of these four applications, if available, can be selected from this Console. Each selection opens the “Application Settings & Network Setup” program in order to make the necessary and/or desired setup for the selected application to follow. This program controls the following features:

- Check whether the application is to be run “as administrator” in windows 7;
- Check whether the application is added to the windows firewall;
- Copy machines or edit existing machines;
- Copy measurement types or edit existing measurement types;
- Setup and connect to Trinity;
- Open the selected application (PI, RI, PA or RA);
- Exit without opening the selected application.

Each item is described in detail in the following sections.

All machine and measurement type settings for each application are held in a central database which is controlled by the Console software. Here machines, measurement types, measuring heads and network adapters are stored to be selected as desired.
The selections are saved in one windows configuration file: ‘ConsoleConfig.ini’. This file is read from and written to by the Console software, and ONLY read by the selected application at start up.
A description of how to use the database is described in section 5; the layout of the database and the connecting configuration file is described in appendix A.

4.2 Application settings & network setup

When one of the four main applications is selected (by pressing the appropriate icon), the "APPLICATION SETTINGS & NETWORK SETUP" program is started and appears with the following screen (in this case the 'Rotary Inspector' is selected):

Figure 4-2 Start screen

The selection field and buttons on the lower right corner of the screen have the following functions:

Probe selection field	Here, the probe to be used can be selected without the need of logging in into the settings (see section 4.2.1).
CONNECT	This will setup and start the wireless connection between the application and the probe (see section 4.2.2).
SETTINGS	After logging in into this section, the settings of the wireless connection can be changed (see section 4.2.3): 1. Select network adapter 2. Select probe 3. Machines can be added, edited or removed from the local database 4. Rotary Inspector only: local machines can be linked to machines in a global database when using the "Rotary Inspector Data Manager"
CONTINUE	When the wireless connection is established the selected application will start, while this "APPLICATION SETTINGS & NETWORK SETUP" application will be shut down.
SYNCHRONIZE	Rotary Inspector only: this button will only appear when the "Rotary Inspector" is selected AND the Rotary Inspector Data Manager is in use. Pressing this button will synchronize history data, settings and measurement results in PDF format with linked machines in the global database. The Rotary Inspector Data Manager functions are described in section 6.
EXIT	Exits this application returns control to the screen shown in Figure 4-1.

4.2.1 The “Probe Selection” field

Figure 4-3 Select a probe

Another probe can be selected immediately from the pull down field without logging in into the ‘Settings’ section.

4.2.2 “CONNECT” button

Pressing the “CONNECT” button will show the settings popup screen prior to connection (Fig. 4-4):

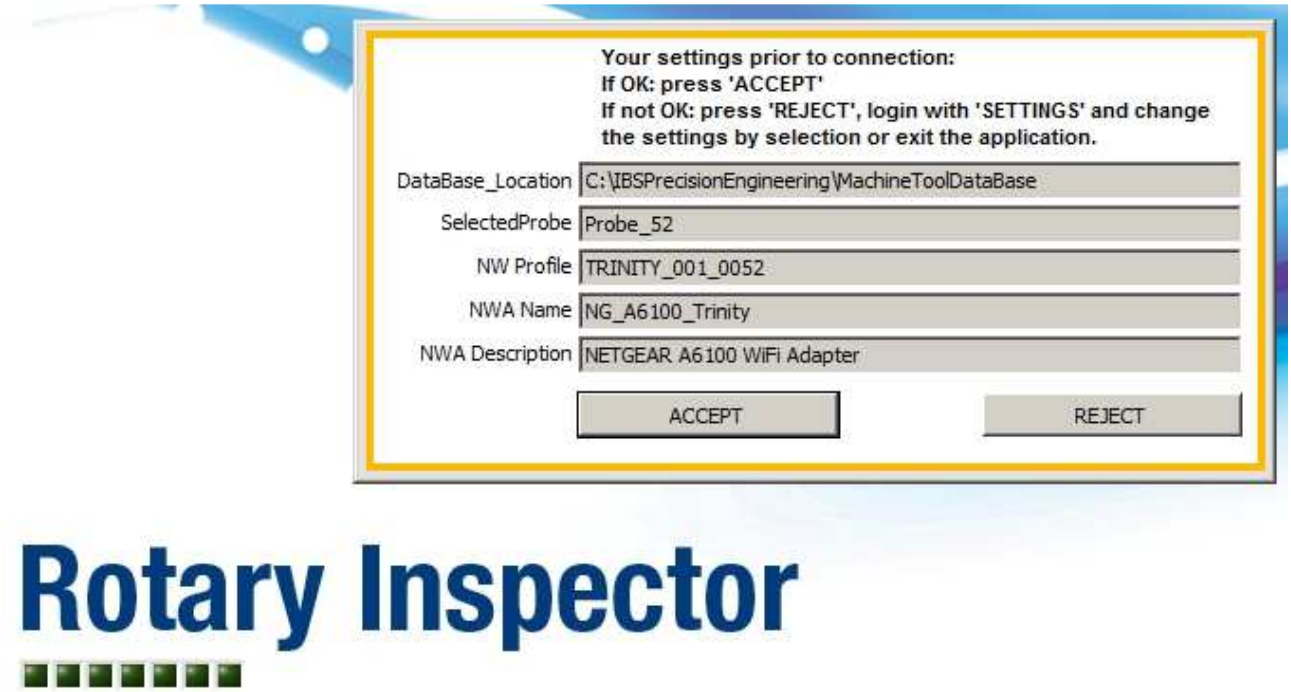


Figure 4-4 Settings prior to connection

If the settings are correct, press “ACCEPT” and the network will be setup and the Trinity connection will be established. See fig. 4-8.

The program automatically checks the status of the selected application and sets up the wireless network. The progress of this automatic setup is monitored using seven LED’s which turn to green (success) or red (fail):

The first two LED’s represent the check on the application for the following settings:

1. Setting of the “Run as administrator” option in windows;
2. Setting of the application to be allowed to run in the windows firewall.

The next five LED’s show the entire setup of the wireless network:

3. Load configuration settings of the wireless probe;
4. Setting the correct static IP address on the network adapter;
5. Load wireless network profile into windows;

6. Connect computer through the access point to the wireless probe;
7. Check connection and start data streaming.

When all LED's turn to green, the application and wireless network are setup correctly.

If any one of these actions fail, the corresponding LED turns red and the startup sequence is aborted, asking the user to login (press 'SETTINGS') and correct the problem. A description of the problem is displayed on screen.

If the settings are not correct, i.e. another network adapter and/or probe needs to be selected, press "REJECT" and login into the settings section by pressing the "SETTINGS" button.

4.2.3 "SETTINGS" button

When another network adapter (NWA) needs to be selected, press "SETTINGS" to login into the settings section and change the selection of the network adapter. The following login screen will appear:

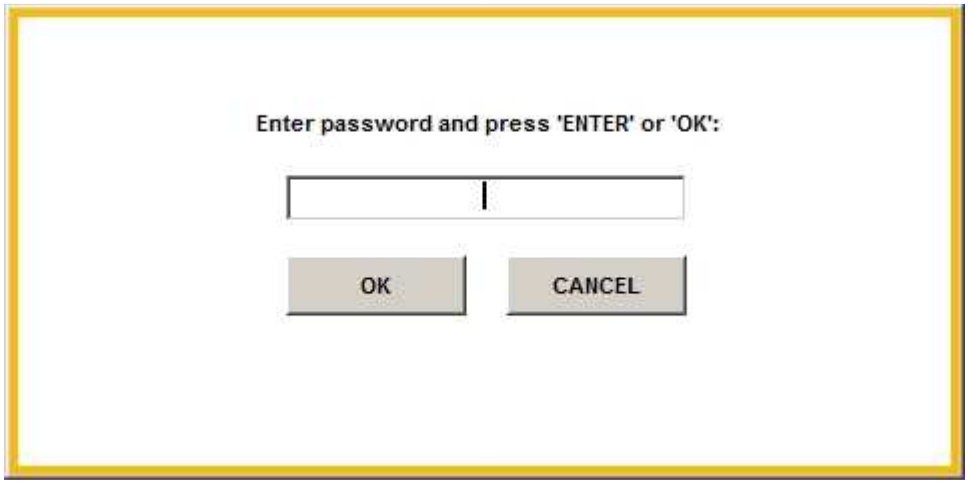


Figure 4-5 Login

After entering the password (see Appendix C) and 'Enter' on the keyboard or 'OK' on the screen, the "SETTINGS" section appears which is divided into four blocks:

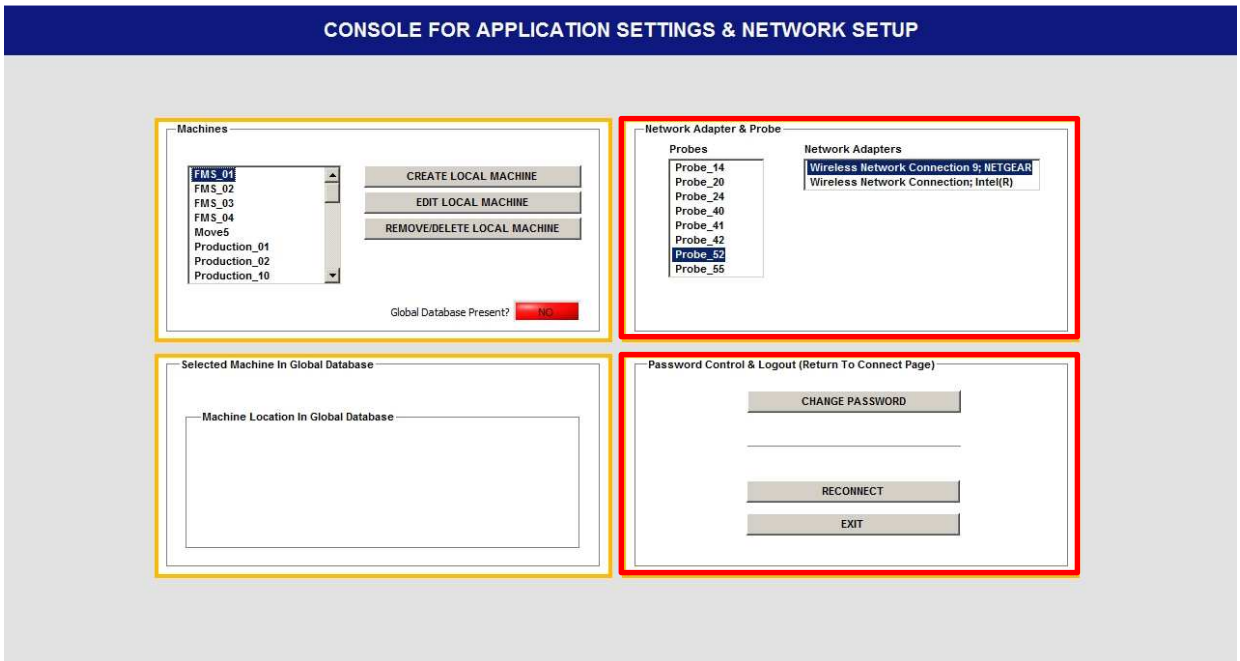


Figure 4-6 Settings screen

In the block at the upper right corner the correct probe and wireless network adapter can be selected. Note that two wireless network adapters are shown in the list.
Normally, the USB type network adapter (NetGear) which comes with the system is used for this purpose. It is also possible to select the internal network adapter if one is available. For this selection it is mandatory to login into the “SETTINGS” section.
Very important note when using the internal network adapter: this adapter is usually setup to work with a company’s internal wireless network which issues IP-addresses automatically. This application changes this setting to a fixed IP-address in a specific address range to work with the ‘Trinity’ system which will disconnect the internal network adapter from the company’s wireless network. It is therefore NOT recommended to use the internal network adapter with the ‘Trinity’ system.

After selecting the proper network adapter and/or probe, the “SETTINGS” section can be closed in two ways using the buttons in the lower right block:

1. Pressing “RECONNECT”, which will immediately close the “SETTINGS” section and shows the connection settings as shown in Figure 4-4 from where the connection can be set up.
2. Pressing “EXIT”, which will also close the “SETTINGS” section and will return control to the previous screen (Figure 4-2).

Both left blocks on the “SETTINGS” section are database related and will be described in section 5: “Database”.

Pressing “ACCEPT” on the network settings popup screen shown in Figure 4-4; the wireless network will be set up as described in section 4.2.2.

4.2.3.1 Change the password

In this lower right block it is also possible to change the password used to enter the “SETTINGS” section. Press the button “CHANGE PASSWORD”; the following screen appears:

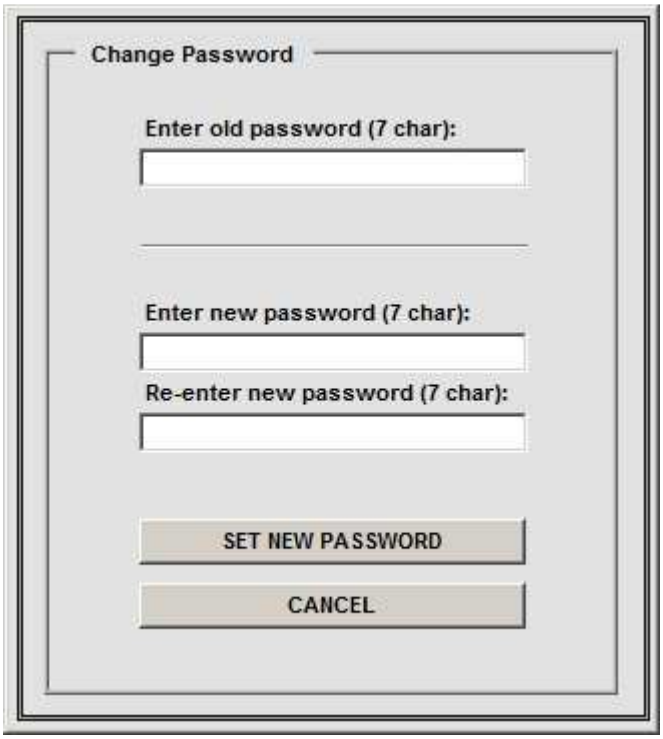


Figure 4-7 Change password

This password is set initially during installation to “welcome”. It can be changed here by entering “welcome” as the old password and the new password in the next two fields. The entries must be 7 characters wide.
Additional note: this password will also be used in the applications.

4.2.4 “CONTINUE” button

When the wireless connection is set up properly, all LED’s on the starting screen will light up green meaning that the wireless network is properly setup and functioning, see Figure 4-8:

Figure 4-8: Application Setting & Network Setup.

Pressing the “CONTINUE” button hides the Console program and starts the selected application. This can be done in two modes:

1. All LED’s have turned green as described above: the selected application is started with full functionality regarding the wireless Trinity system;
2. The setup procedure was aborted (one red LED): the selected application is started without the functionality of Trinity. In this case only the analysis functionality of the selected application (if any) is available.

4.2.5 “SYNCHRONIZE” button

This button only appears when the “Rotary Inspector” application is selected on the startup screen shown in Fig. 4-1.

The function of this button is explained in section 6 where the use of the “Rotary Inspector Data Manager” is described.

4.2.6 “EXIT” button

Pressing the “EXIT” button closes this program and returns control to the Console matrix (see Figure 4-1) where another application can be selected or the Console can be terminated.

4.3 NC code

With all four Machine Tool applications measurements can be performed for which an NC code is required. The NC code descriptions can be found in the relevant user manual of each application.

5 Database

The local database holds the setup, configuration parameters and measurement data performed by inspector packages.

The layout of the database is explained in Appendix A.

5.1 Opening the database for editing

Pressing the 'SETTINGS' button and logging in as shown in Figure 4-5, the 'Settings' section will appear as shown in Figure 5-1:

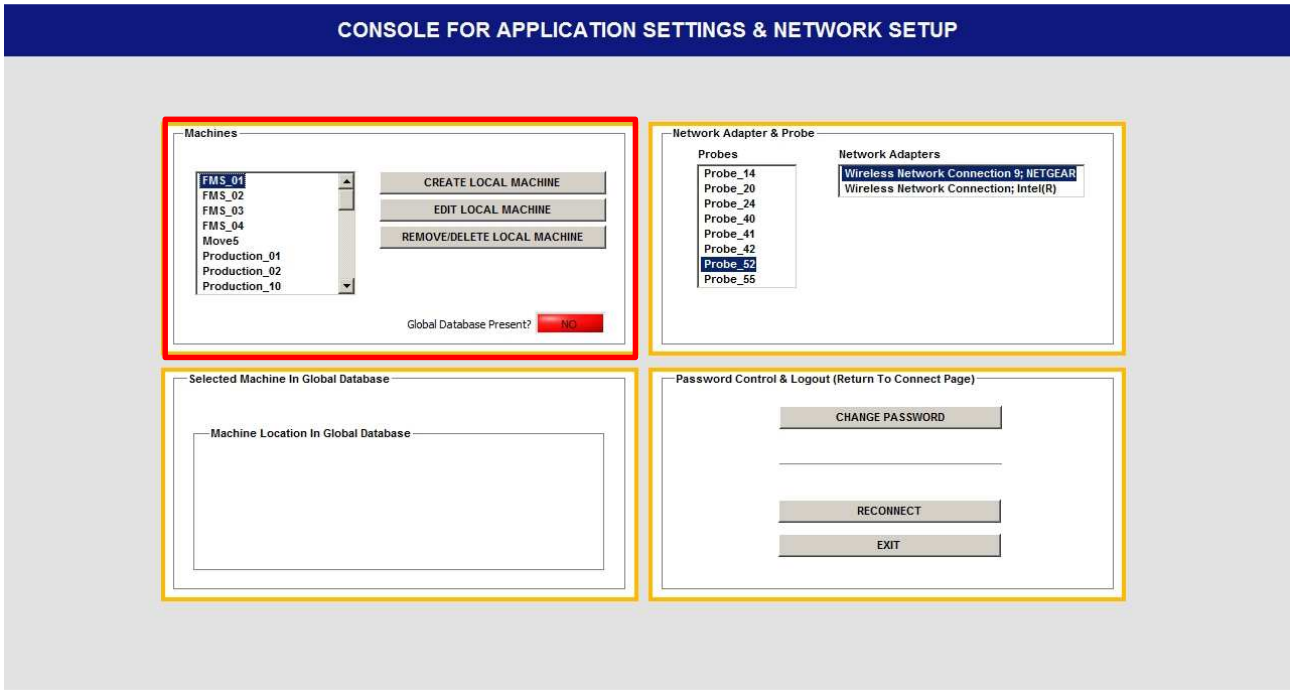


Figure 5-1 Settings & Database settings

The two blocks on the right side are described in section 4.2: Application settings & network setup**.** The lower left block is only relevant when the 'Rotary Inspector' application is used in conjunction with the 'Rotary Inspector Data Manager'. This combination is described in chapter 6: 'Rotary Inspector and RI Data Manager'.
The upper left block is used to add, edit or remove items from the local database:

Machines:

Action	Result
CREATE LOCAL MACHINE	Creates a new machine, see section 5.1.1
EDIT LOCAL MACHINE	Edit an existing machine (if applicable), see section 5.1.2
REMOVE/DELETE LOCAL MACHINE	Remove or delete an existing machine, see section 5.1.3

5.1.1 Create Local Machine

Pressing the ‘CREATE LOCAL MACHINE’ button shows the following screen:

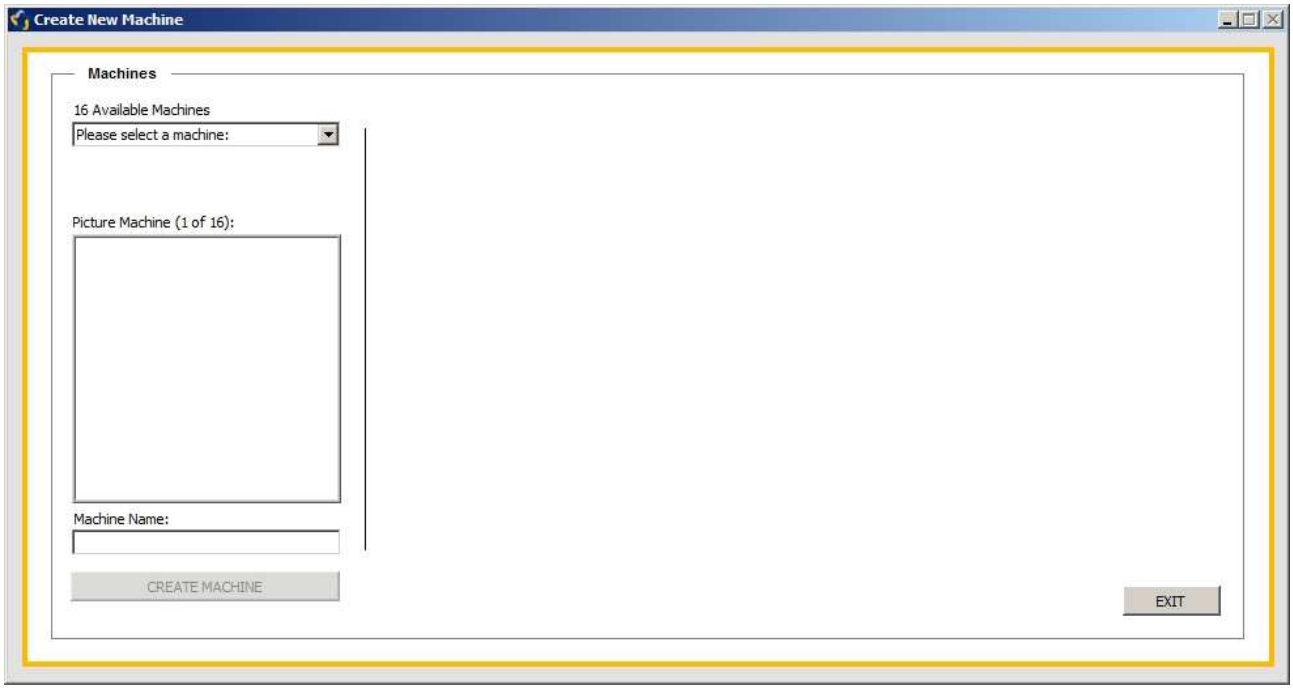


Figure 5-2 Create Local Machine

In the upper left corner a new machine type can be selected from the pull-down list. This list contains 16 predefined machine types (see Fig. 5-3). The item names are explained in appendix H: Machine types explained.

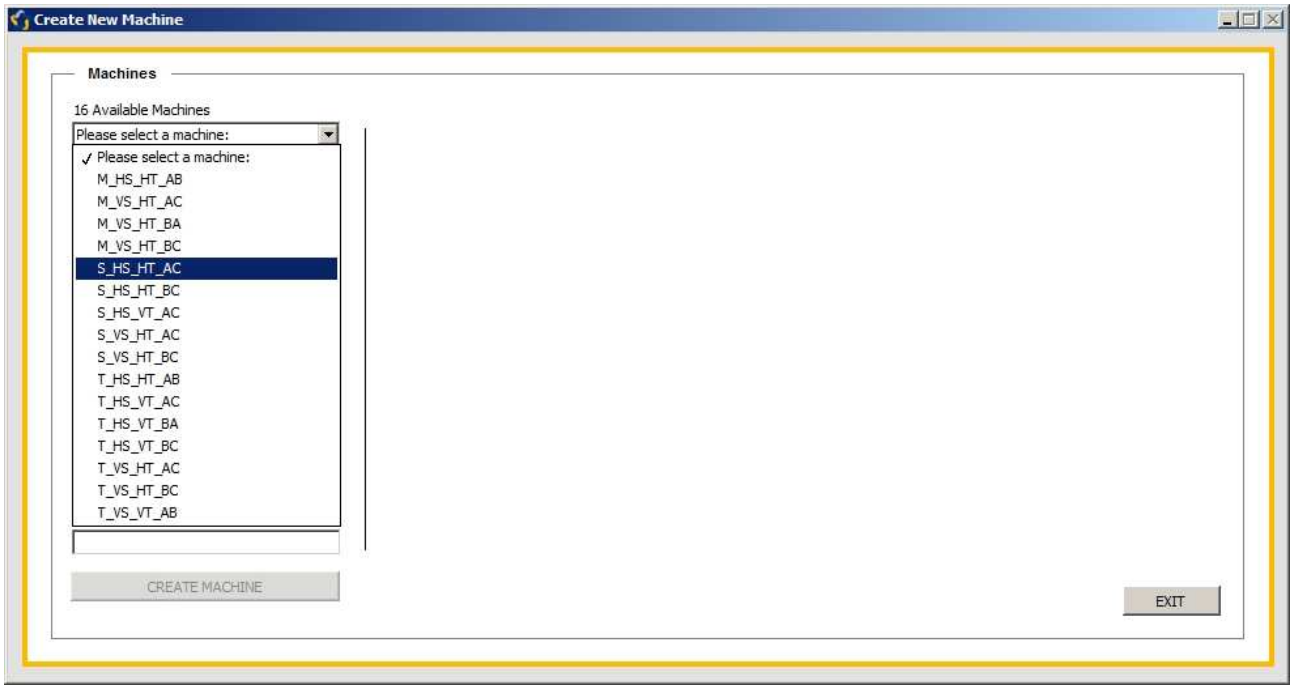


Figure 5-3 Select Machine Type

Once a machine type is selected, a picture is shown in the frame underneath the pulldown list (see Figure 5-4:

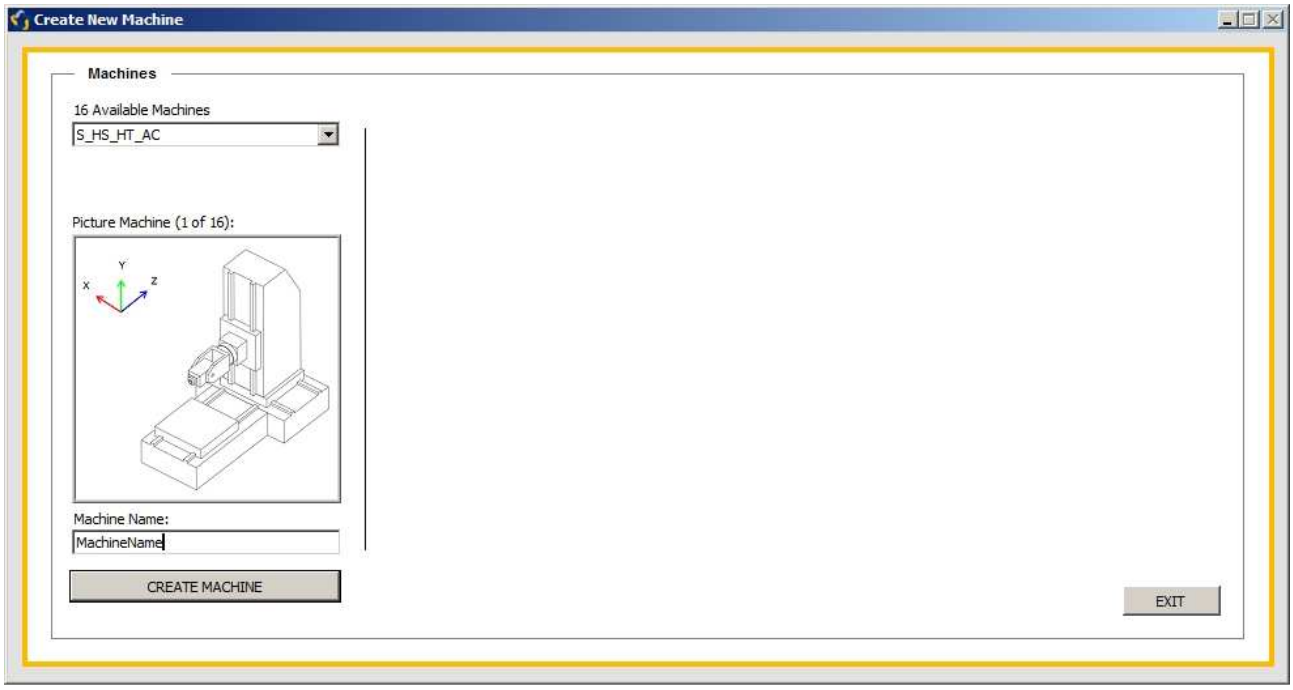


Figure 5-4 Local Machine Type selected

Next, a name must be assigned to the machine. Pressing 'CREATE MACHINE' creates the machine in the database structure and disables the controls on the left side the screen to prevent multiple inputs which is not possible (see Figure 5-5):

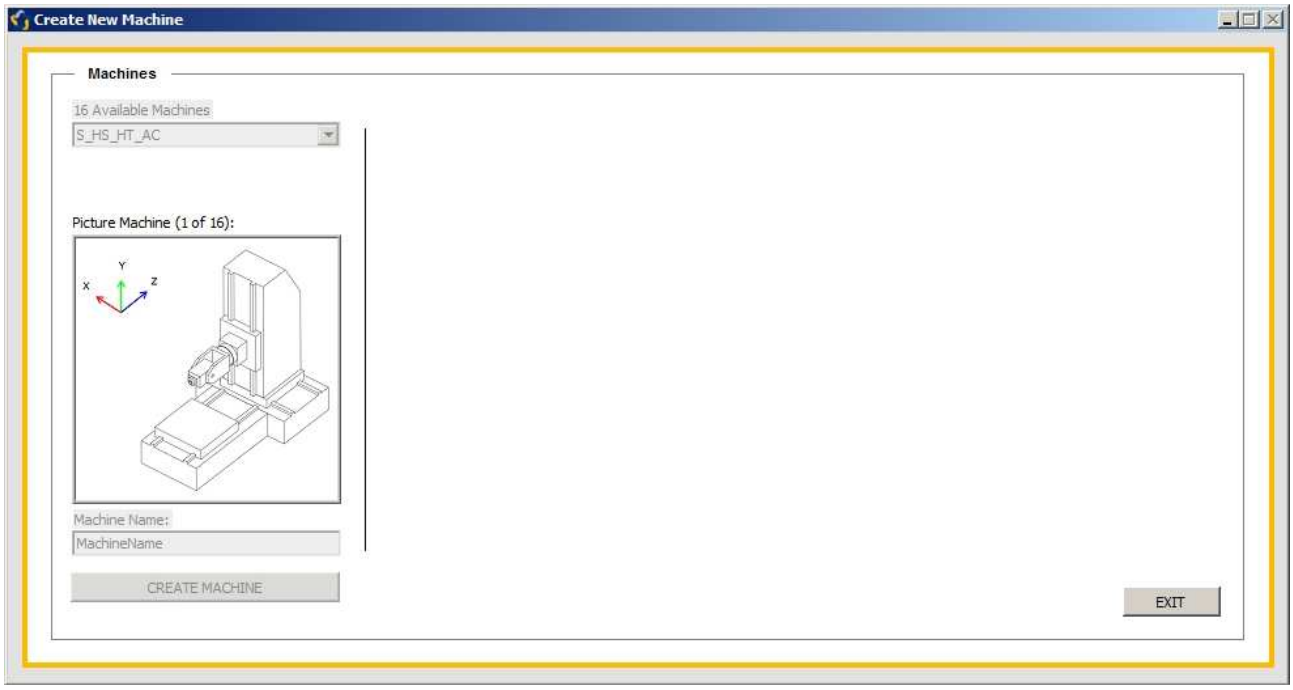


Figure 5-5 New Local Machine created

When creating a new machine, the measurement types associated with the application are created in a pre-defined way in the appropriate directories.

Press 'EXIT' to return control to the 'Settings' section.

5.1.2 Edit Local Machine

This option is only relevant for both the ‘Position Inspector’ and ‘Rotary Inspector’, see section 5.2. When the ‘EDIT LOCAL MACHINE’ button is pressed with the one of the analyzer applications, the following screen appears:

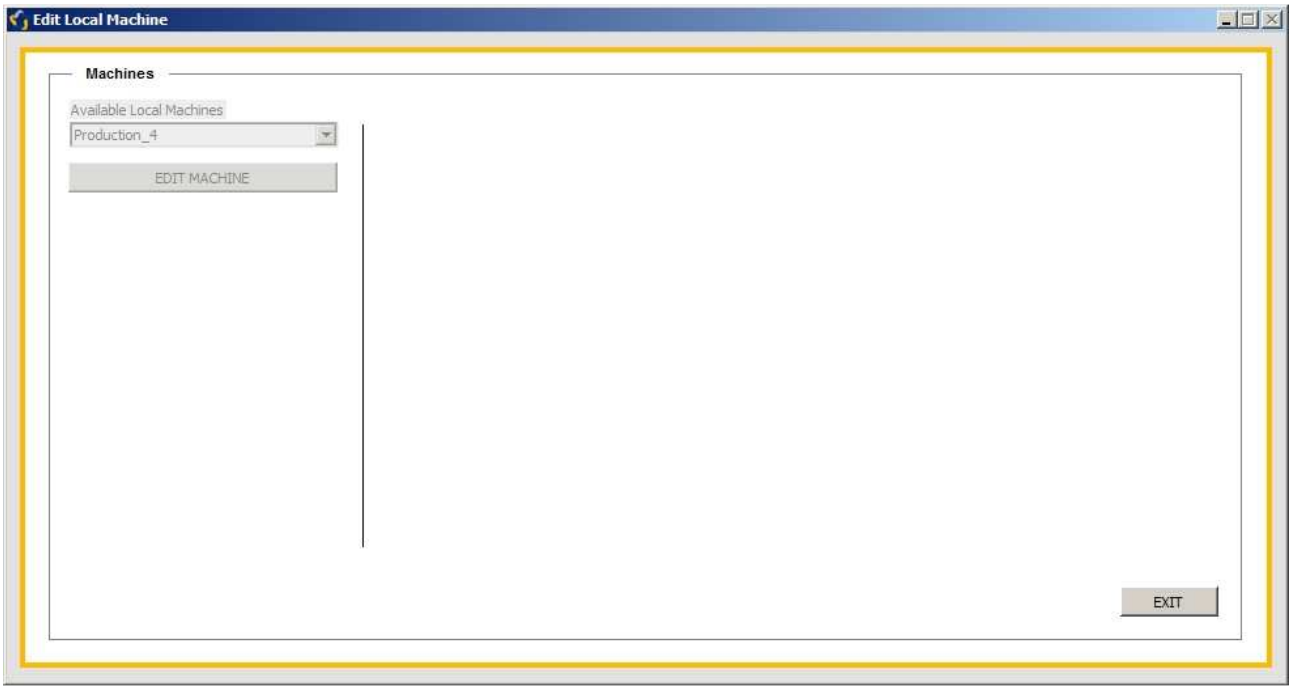


Figure 5-6 Edit Local Machine for analyzer applications

All parameter settings for the analyzer applications can be edited using the applications themselves. Press ‘EXIT’ to return control to the ‘SETTINGS’ section.

5.1.3 Remove or delete a Local Machine

Pressing ‘REMOVE/DELETE LOCAL MACHINE’ shows the following popup:

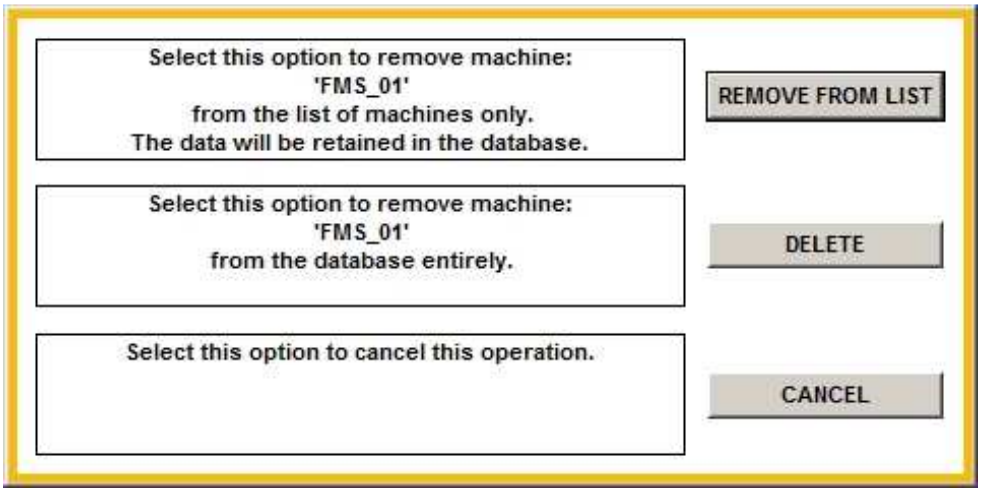


Figure 5-7: Remove/rename Local Machine

Pressing ‘REMOVE FROM LIST’ only removes the machine from the list so it cannot be selected; it is NOT removed from the database.

Pressing ‘DELETE’ removes the machine entirely from the database, including all measurement results from that machine.

Pressing ‘CANCEL’ aborts this operation.

5.2 Parameter settings

In this section the parameter settings for each of the inspector applications are explained. These parameters can also be set during the creation of a local machine.

5.2.1 Parameter setting for “Position Inspector”

When ‘EDIT LOCAL MACHINE’ is pressed as described in section 5.1.2, a machine is selected and ‘EDIT MACHINE’ is pressed, the following screen appears for the Position Inspector:

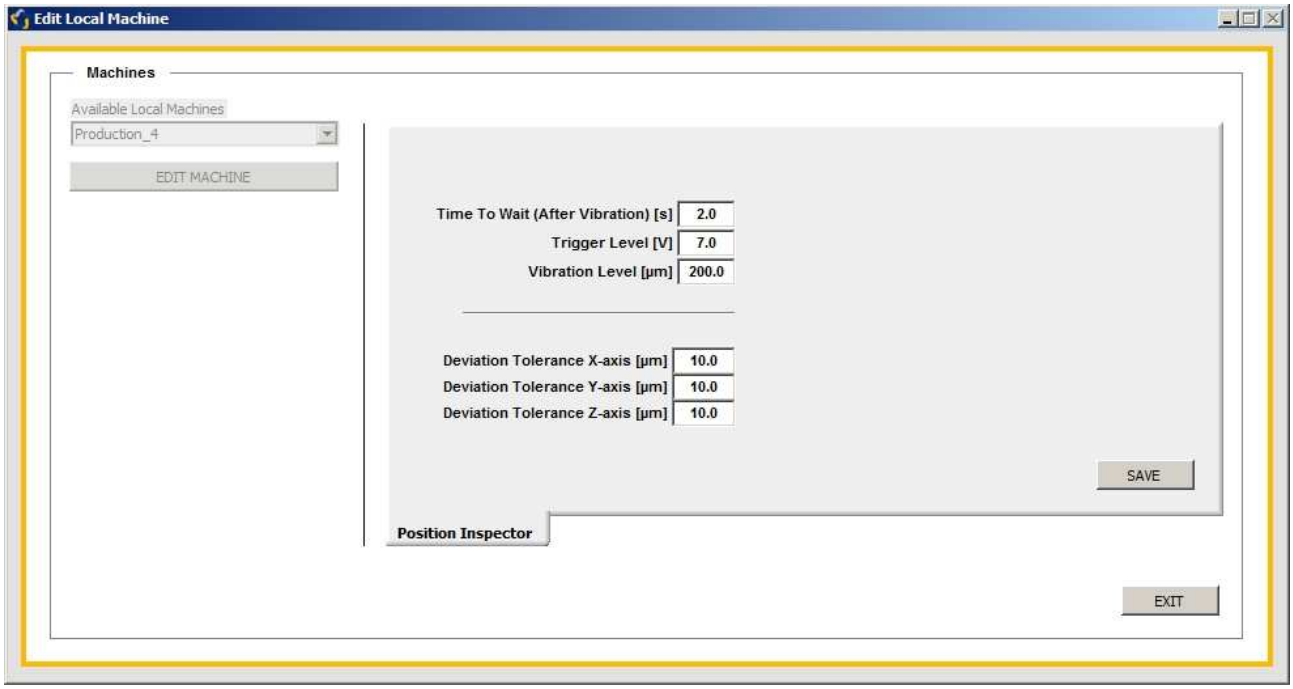


Figure 5-8 Parameters for Position Inspector

- Machine parameters for “Position Inspector”
- Measurement type parameters for “Position Inspector”

Parameter name	Explanation
Time to wait (After Vibration) [s]	When the vibration level criterion is met after positioning the measuring head on the artefact ball, the system waits the amount of seconds set with this parameter before a measurement point is taken.
Trigger Level [V]	Measurement of the vibration level criterion is triggered when all three sensors of the measuring head measure below the voltage set with this parameter.
Vibration Level [µm]	When the measuring head is positioned on the artefact ball, the residual system vibration may not exceed the value set with this parameter.
Deviation Tolerance X-axis [µm]	With this parameter the maximum deviation with respect to the reference run results is set for the X-axis. See Figure 5-9.
Deviation Tolerance Y-axis [µm]	With this parameter the maximum deviation with respect to the reference run results is set for the Y-axis. See Figure 5-9.
Deviation Tolerance Z-axis [µm]	With this parameter the maximum deviation with respect to the reference run results is set for the Z-axis. See Figure 5-9.

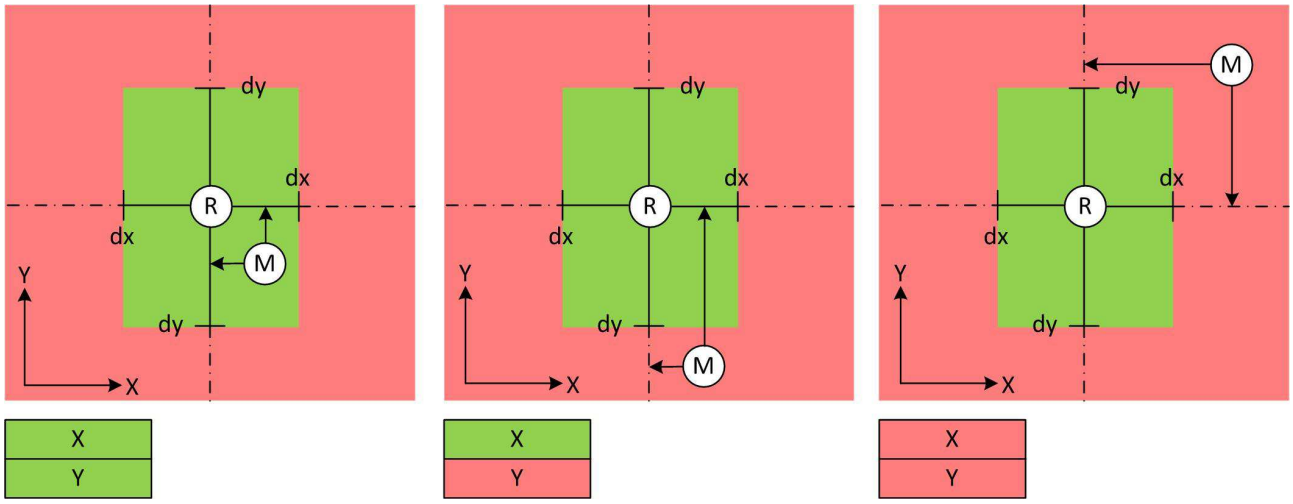


Figure 5-9 Explanation deviation tolerance.

Deviation tolerance dx, dy. R shows the reference run position, M the measured position. Left X and Y in tolerance, middle X in and Y out tolerance, right X and Y both out of tolerance.

Press ‘SAVE’ to save the values in the database.

Press ‘EXIT’ to return control to the ‘SETTINGS’ section.

5.2.2 Parameter setting for “Rotary Inspector”

When ‘EDIT LOCAL MACHINE’ is pressed as described in section 5.1.2, a machine is selected and ‘EDIT MACHINE’ is pressed, the following screen appears for the Rotary Inspector:

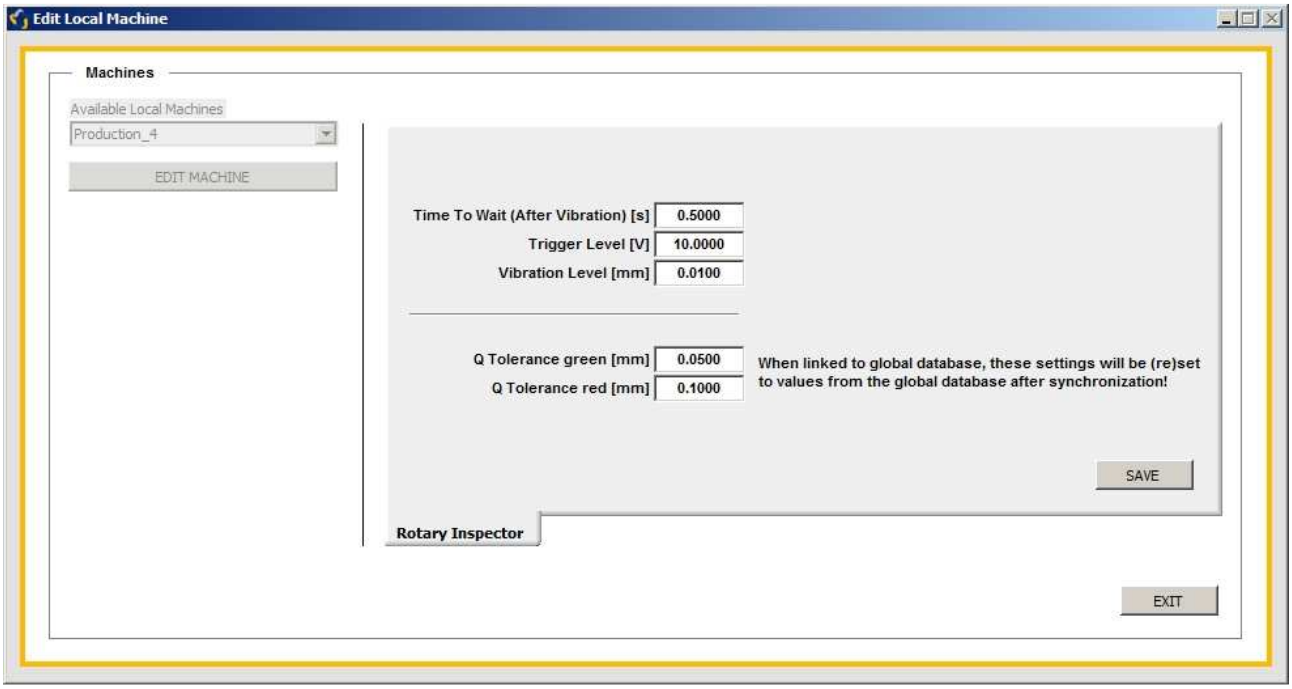


Figure 5-10 Parameters for Rotary Inspector

Parameter name	Explanation
Time to wait (After Vibration) [s]	When the vibration level criterion is met after positioning the measuring head on the artefact ball, the system waits the amount of seconds set with this parameter before a measurement point is taken.
Trigger Level [V]	Measurement of the vibration level criterion is triggered when all three sensors of the measuring head measure below the voltage set with this parameter.
Vibration Level [µm]	When the measuring head is positioned on the artefact ball, the residual system vibration may not exceed the value set with this parameter.
Q Tolerance green [mm]	This level represents the lower limit of the Q-value, the meaning of this value is explained in the Rotary Inspector user manual section 3.1.
Q Tolerance red [mm]	This level represents the upper limit of the Q-value, the meaning of this value is explained in the Rotary Inspector user manual section 3.1.

Note that when the Rotary Inspector is used in conjunction with the Rotary Inspector Data Manager, both Q tolerance values are overwritten by the values saved for this machine in the global database when:

1. The local machine is linked to a machine in the global database
2. Both machines are synchronized

Synchronization will be explained in section 6.

Press ‘SAVE’ to save the values in the database.

Press ‘EXIT’ to return control to the ‘SETTINGS’ section.

6 Rotary Inspector and RI Data Manager

When multiple machines, which may be situated in more than one location, are measured with the Rotary Inspector, the system can be extended with the Rotary Inspector Data Manager. This includes:

1. A global database in which a history of all measurement results and reports are gathered through synchronization between the global database and one or more local databases situated on computers/laptops used for measurement with the Rotary Inspector.
2. Several means of presenting and reporting results of one or more machines over time. This presentation and reporting can be performed for a single machine or a group of machines which are situated in a specific location by choice. This can be all machines in a plant, a group of machines located in a single department within a plant or a group of machines located within a single cell which, in turn, is part of a department. Full description of the RI Data Manager can be found in the appropriate user manual.

For correct communication between the Console and the RI Data Manager, a wired connection between the PC/laptop running the Console and the network is required.

Here, the interactions of the Console with the RI Data Manager will be described.

6.1 Settings

When the Rotary Inspector is selected from the application matrix shown in Fig. 4.1, the "APPLICATION SETTINGS & NETWORK SETUP" program is started and appears with the screen shown in Fig. 4.2.

As explained, this is the only application showing the 'SYNCHRONIZE' button. Pressing this button will start the synchronization of all machines which are defined in the local database AND are linked to a machine in the global database. During the synchronization a little square box on the button will blink; when finished the square box will disappear.

Figure 6-1 Blinking square box during synchronization

Once the connection between the two databases is established, the global database will be locked for other local databases until the synchronization is finished.
When another local database (a Console located on another laptop) tries to synchronize with the global database when it is locked, the following message appears:

Figure 6-2 Global database locked for synchronization

The synchronization consists of three parts:

1. The measurement history in both databases will be synchronized with each other; this synchronization is executed in both directions which means that all measurement results for all linked machines are available in both databases.
2. All measurement reports in PDF format will be uploaded to the global database from each linked machine in the local database.
3. The measurement tolerance settings for the Q-value will be downloaded from the global database to each linked machine in the local database.

When the synchronization is finished, the global database will be unlocked for access by other local databases or the RI Data Manager for maintenance purposes.

6.2 Opening the database for editing

Pressing the ‘SETTINGS’ button and logging in as shown in Figure 4-5, the ‘Settings’ section for the Rotary Inspector will appear as shown in Figure 6-3:

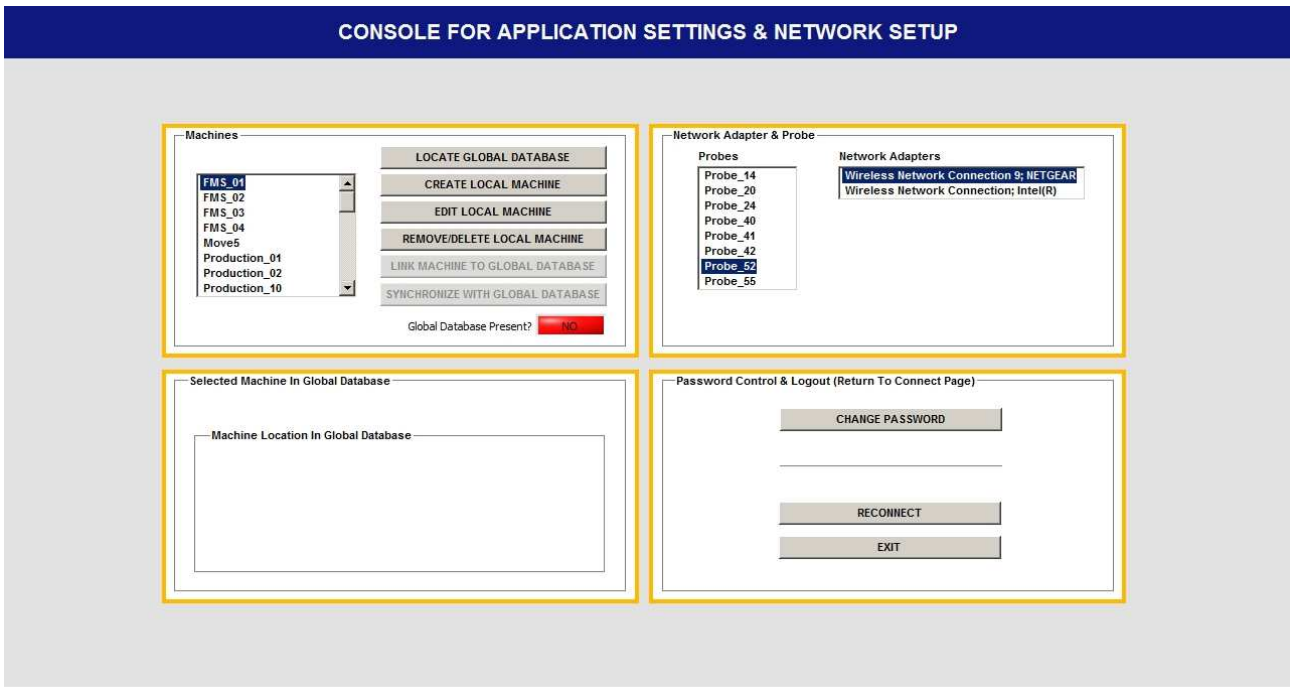


Figure 6-3 Settings screen for Rotary Inspector

Machines:

Action	Result
LOCATE GLOBAL DATABASE	Select the location of the global database
CREATE LOCAL MACHINE	Creates a new machine, see also section 5.1.1
EDIT LOCAL MACHINE	Edit an existing machine (if applicable), see section 5.1.2
REMOVE/DELETE LOCAL MACHINE	Remove or delete an existing machine, see section 5.1.3
LINK MACHINE TO GLOBAL DATABASE	Link a local machine to a machine located in the global database
SYNCHRONIZE WITH GLOBAL DATABASE	Synchronize a local machine with a linked machine in the global database

Note that at initial startup the location of the global database is unknown to the Console and needs to be setup; this is explained in section 6.2.1. This is represented by the red LED stating that the global database is not present.

6.2.1 Locate Global Database

The global database and its location is setup by the RI Data Manager and is usually found on a network drive or mapping marked by a specific drive letter. At initial startup of the Console, the location of the global database needs to be entered. Once the database is found, the location is saved in the initialization files of the Console and will be recognized at startup.

Pressing the button ‘LOCATE GLOBAL DATABASE’ opens the following windows screen:

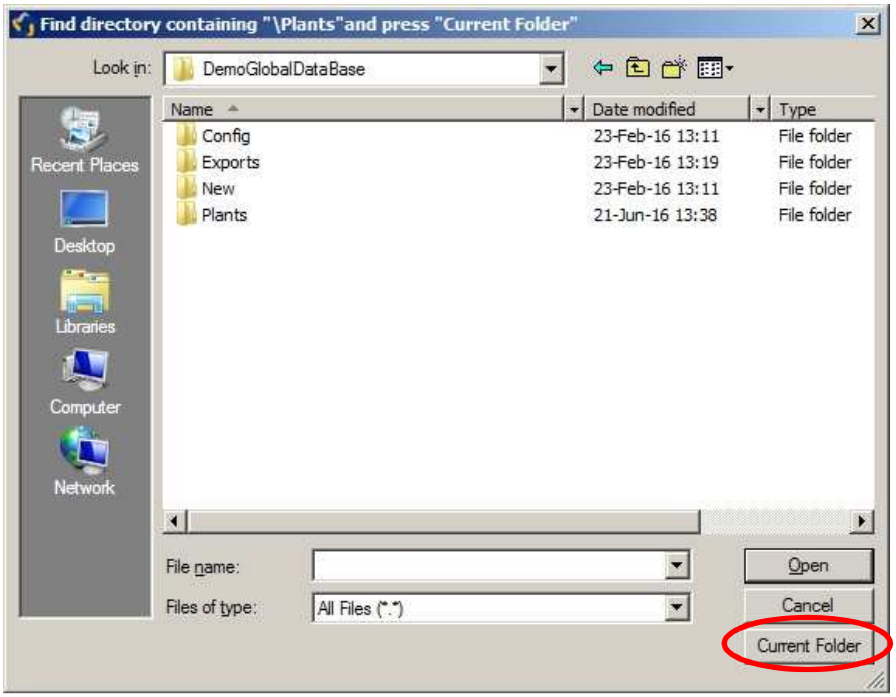


Figure 6-4 Locating the global database

Find the network directory which contains the subdirectory ‘Plants’ and press ‘Current Folder’, the ‘Settings’ section for the Rotary Inspector will re-appear as shown in Figure 6-5:

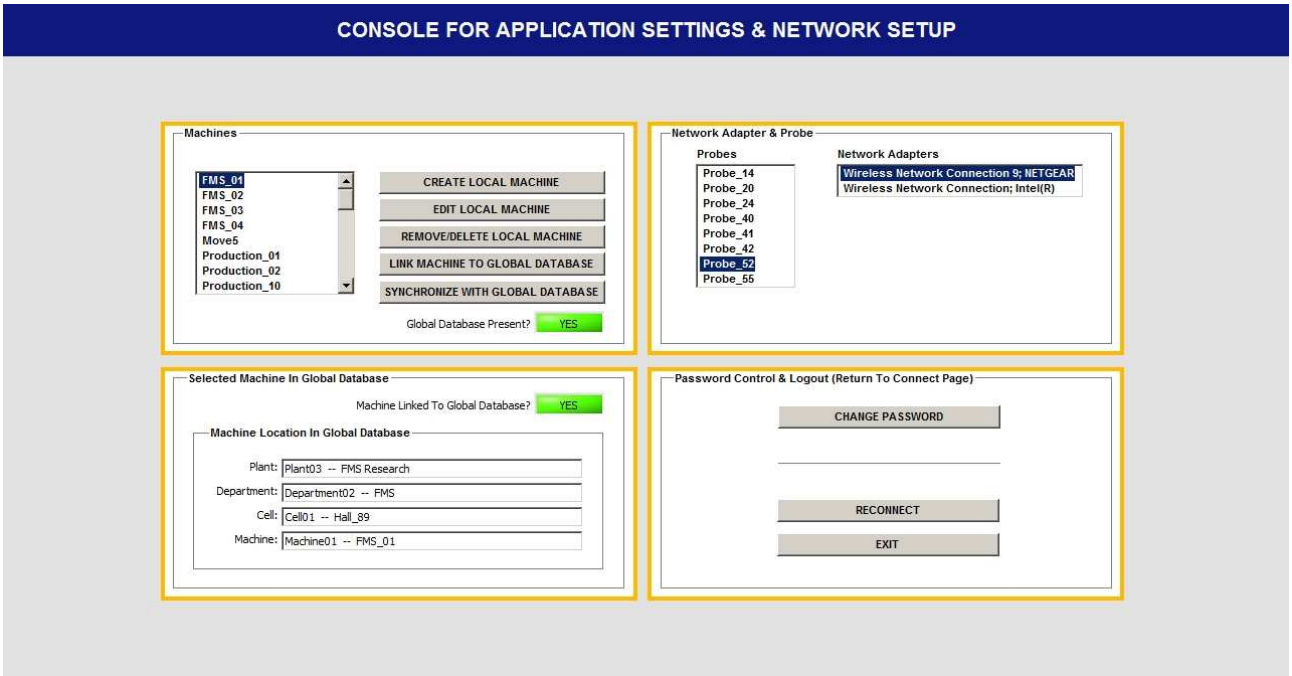


Figure 6-5 Settings screen for Rotary Inspector with global database present

Note that the button ‘LOCATE GLOBAL DATABASE’ has disappeared from the screen and that the ‘LINK’ and ‘SYNCHRONIZE’ buttons are enabled.

When the selected machine in the upper left block is linked to the global database (green LED), the lower left block shows the link information about the local machine in the global database.

6.2.2 Create Local Machine

Pressing the ‘CREATE LOCAL MACHINE’ button shows the following screen:

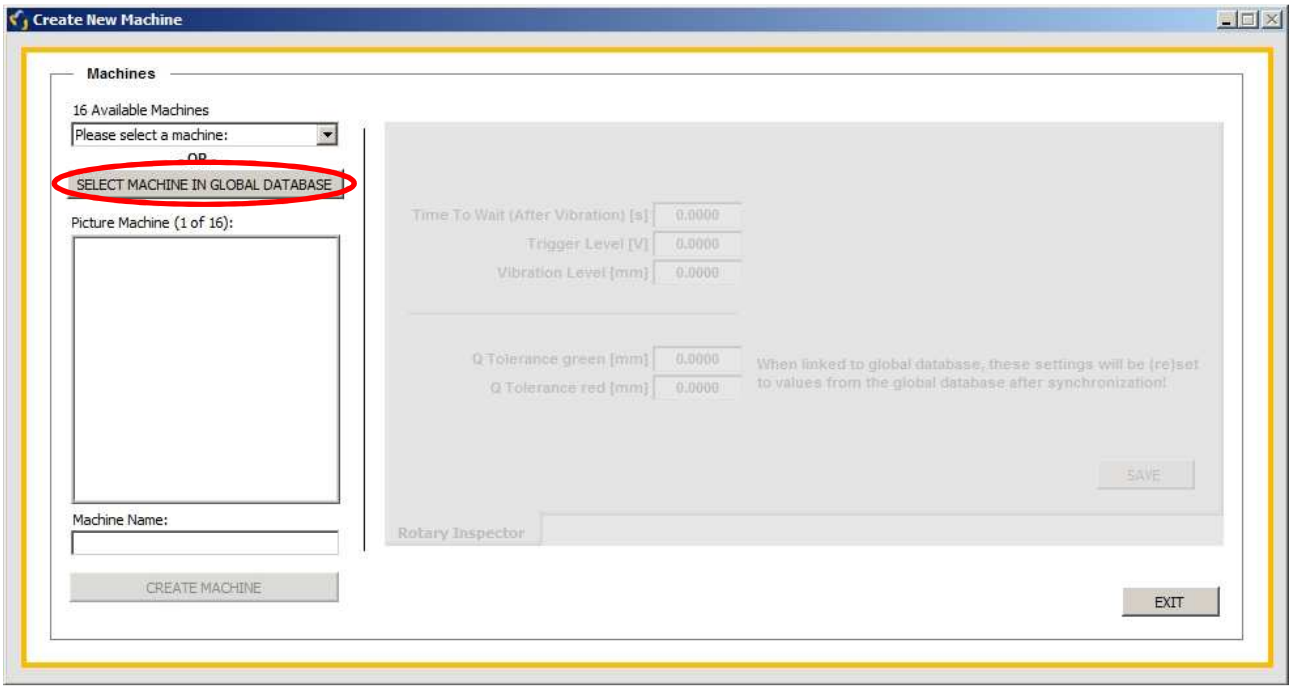


Figure 6-6 Create Local Machine

The creation of a new local machine is similar to the procedure described in section 5.1.1. In conjunction with the global database, a second option for creating a local machine is implemented.

6.2.2.1 Creating a local machine from the global database

When the local machine to be created already exists in the global database and there is no active link to this machine, it is possible to download this machine and define this as the new local machine. The advantage of this method is that the new local machine is automatically linked to and synchronized with the original machine in the global database.
Press the button ‘SELECT MACHINE IN GLOBAL DATABASE’. The following screen pops up:

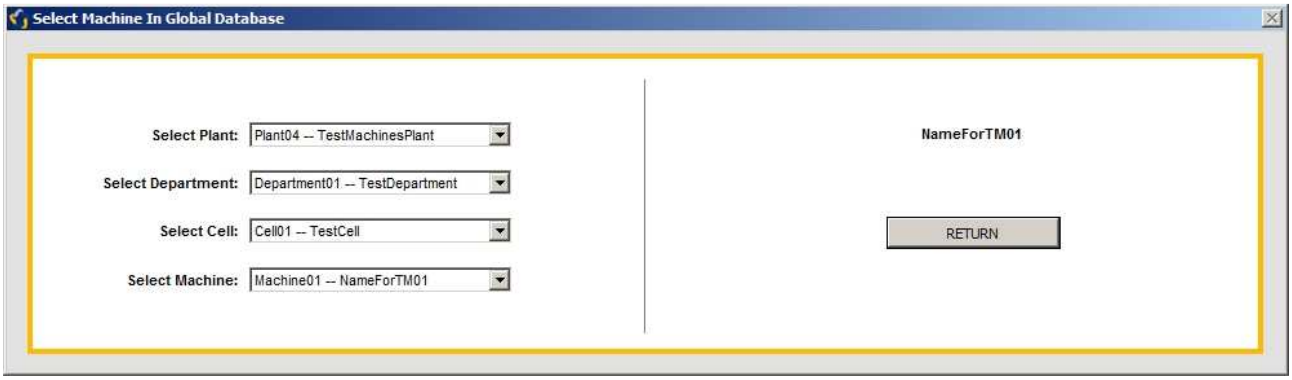


Figure 6-7 Selecting the machine in the global database

On the left side of the screen four pull down fields can be used to select the machine to be downloaded:

1. Select available plant
2. Select available department
3. Select available cell
4. Select available machine (Figure 6-8):

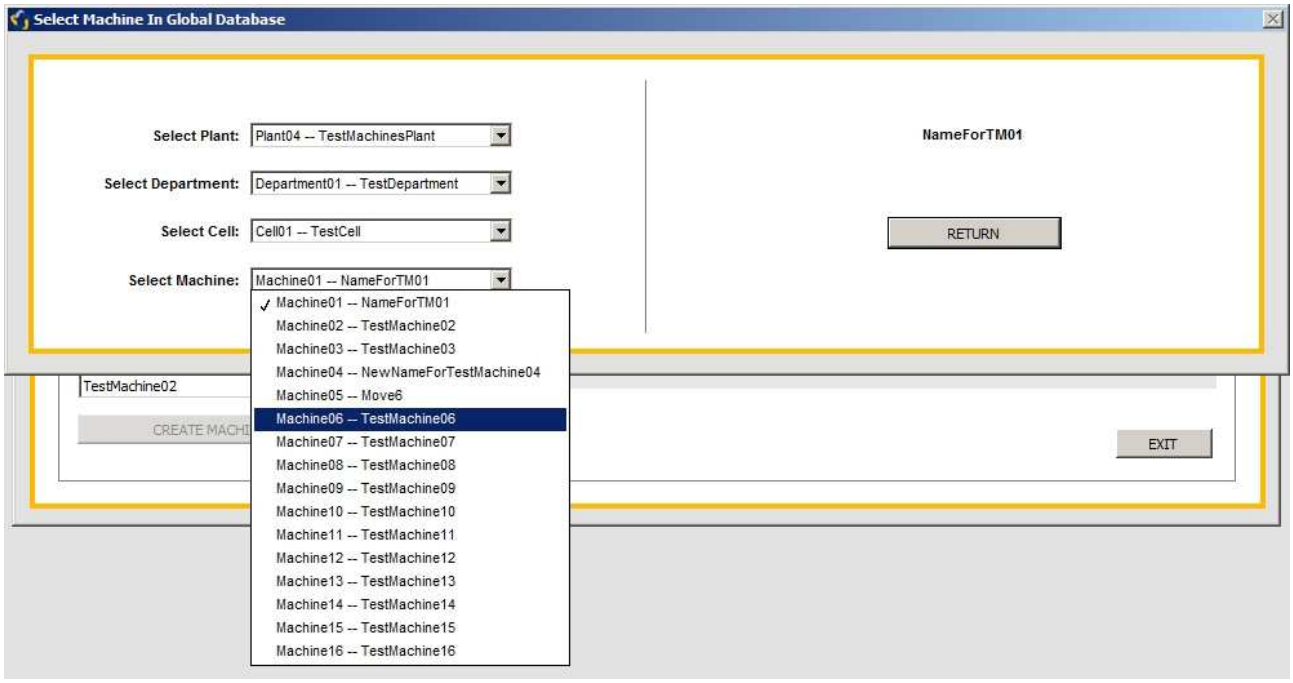


Figure 6-8 Select machine to download

Press ‘RETURN’.

When the selected machine is already linked to a local machine the following warning appears:

Figure 6-9 Machine link already exists

In this case, another machine must be selected. The download procedure is aborted at this point and returns control to the screen shown in Figure 6-6 where the procedure can be restarted.

If the download succeeds, the previous screen appears with the new machine selected:

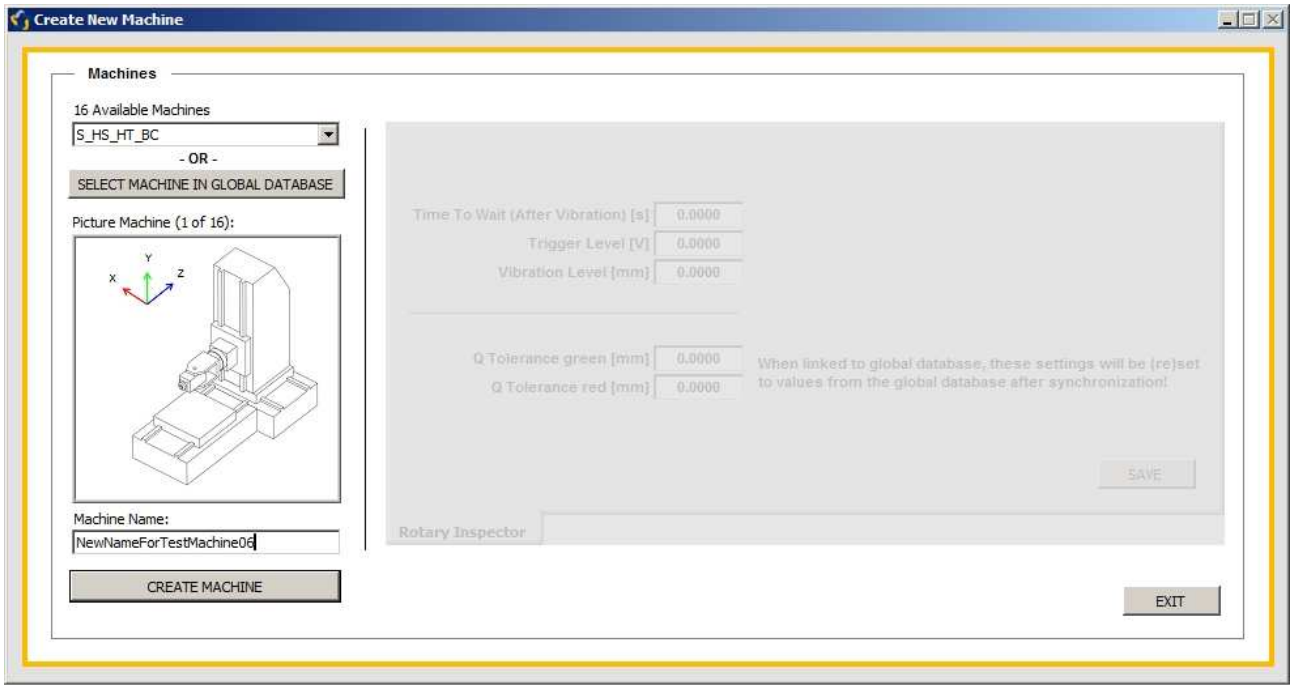


Figure 6-10 Machine selected from global database

The ISO description (in this case S_HS_HT_BC) for the selected machine is explained in appendix H.
Enter the machine name and press ‘CREATE MACHINE’. The tab on the right side of the screen will be enabled:

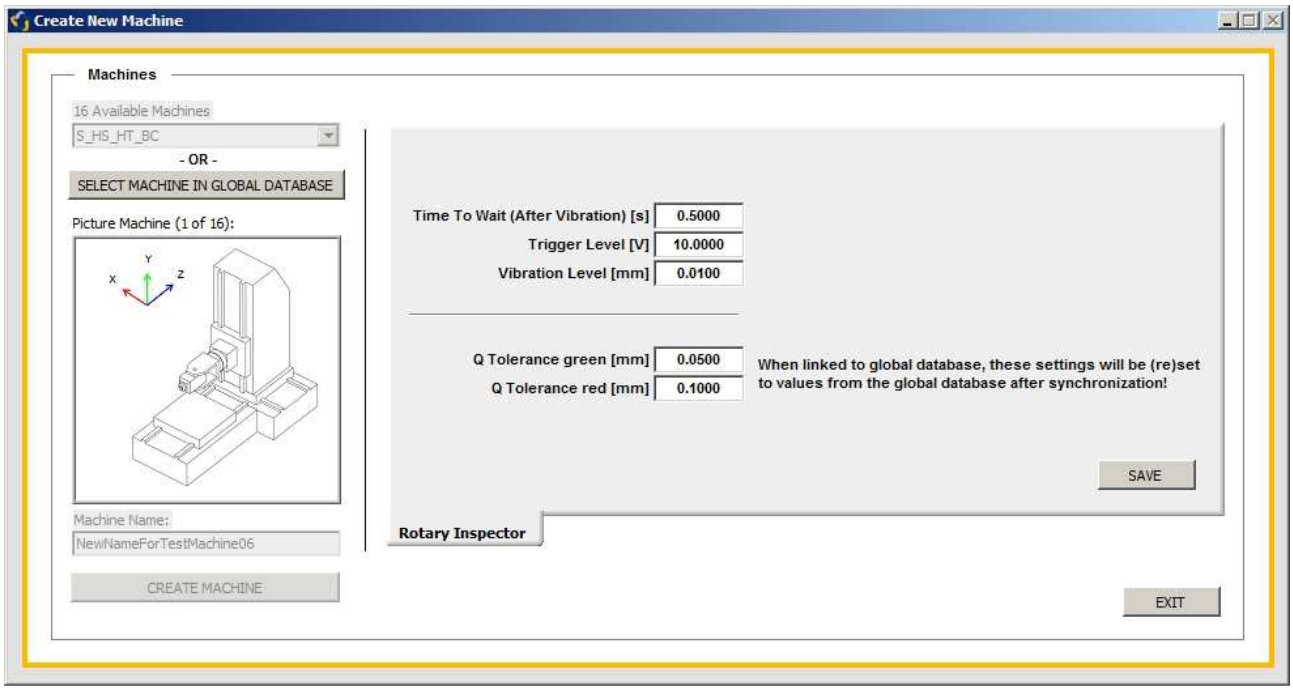


Figure 6-11 Set parameters

Here the parameters can be set for the new machine individually; it must be noted however that when the machine is synchronized, the Q-tolerance values will be downloaded from the global database and are set in the local machine: the Q-tolerance values from the global database are therefore leading over the local database. The parameters can be saved by pressing ‘SAVE’.

Press ‘EXIT’ to return to the ‘Settings’ section.

6.2.3 Edit local machine

A full description is given in section 5.1.2.

6.2.4 Remove/Delete local machine

A full description is given in section 5.1.3.

6.2.5 Link local machine to global database

To link an existing local machine to an existing global machine, press ‘LINK MACHINE TO GLOBAL DATABASE’. The following screen will pop up:

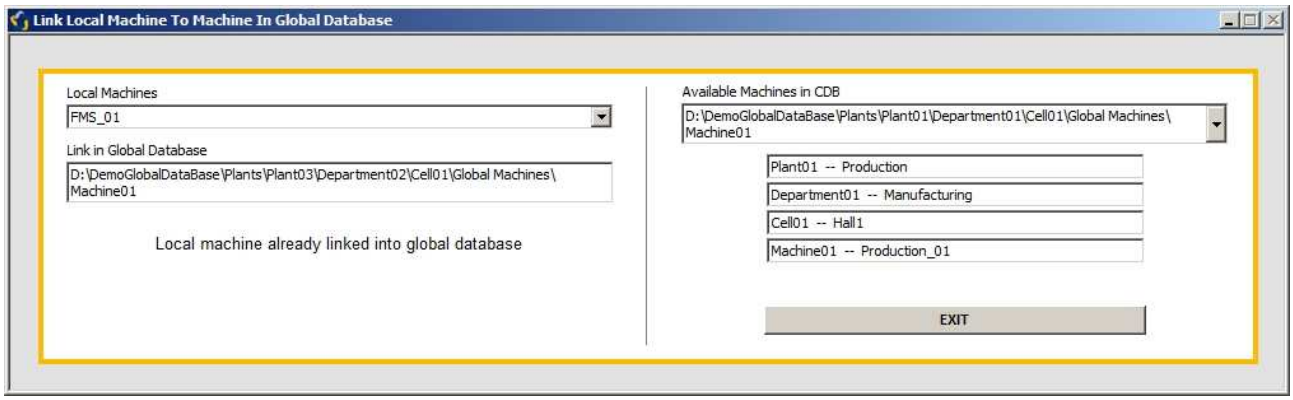


Figure 6-12 Linking an existing local machine to an existing global machine

The screen opens with the first machine in the local database; this machine is already linked into the global database: the link path is shown in the left part of the screen.

Select the local machine to be linked in the pull down field on the upper left side of the screen:

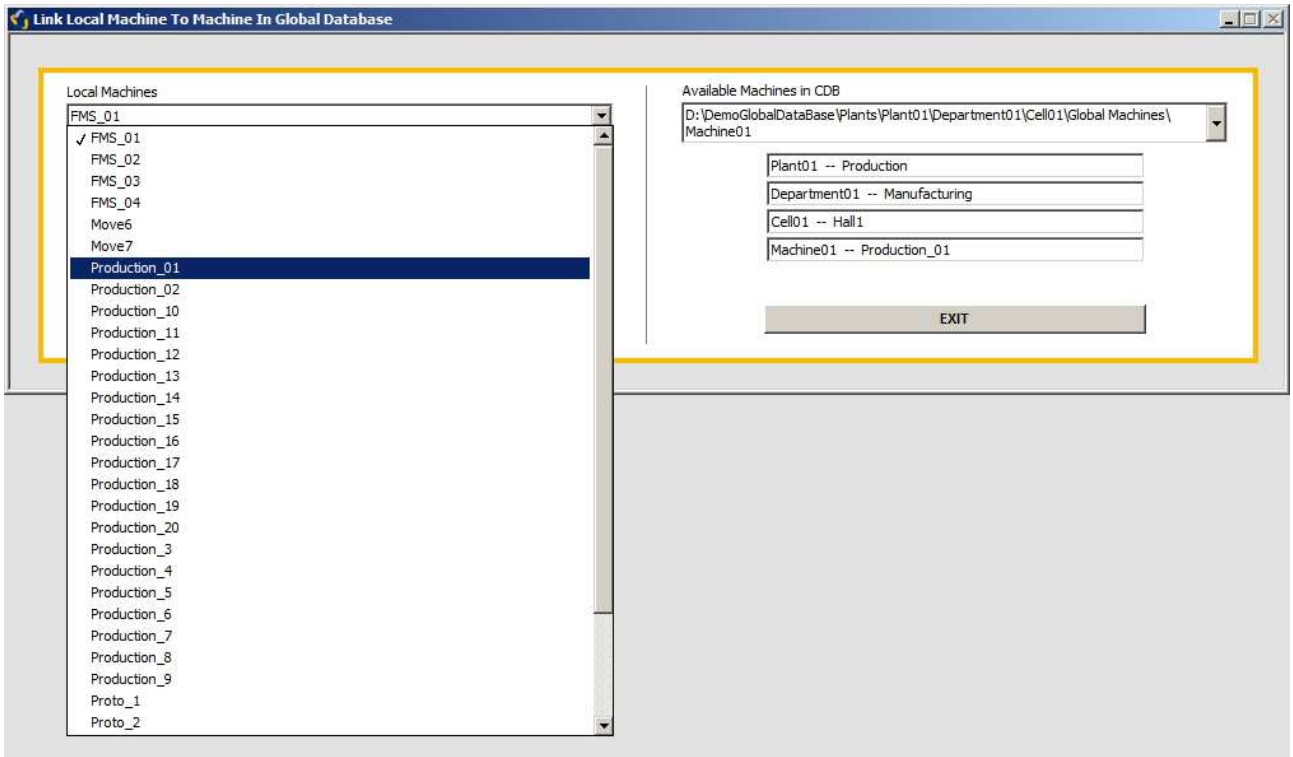


Figure 6-13 Select local machine to be linked

No link exists for this machine at this point:

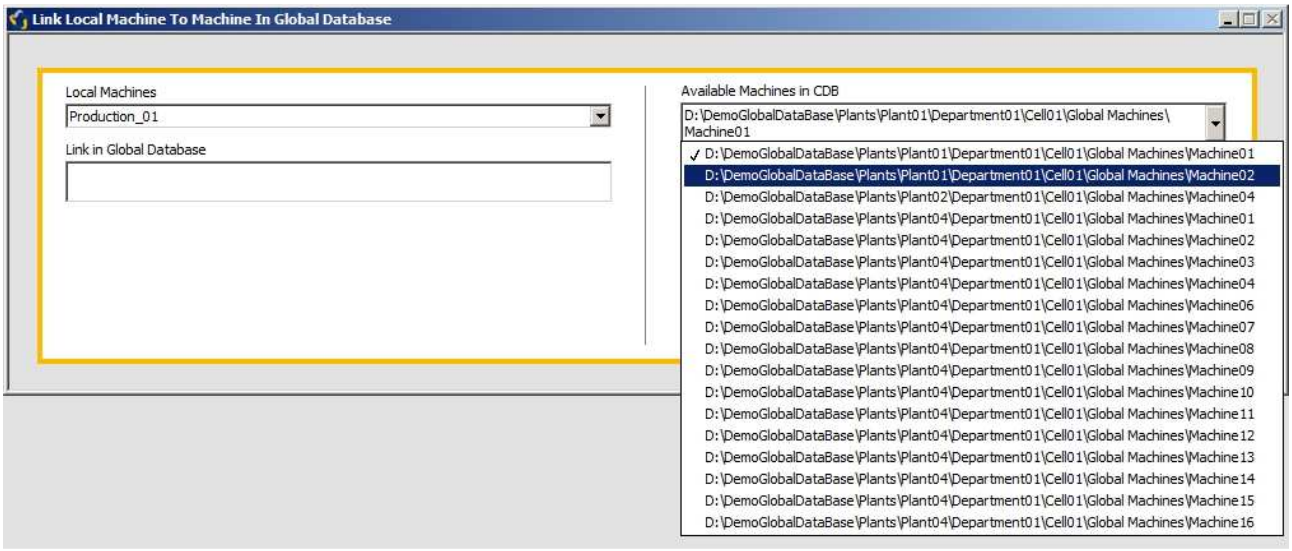


Figure 6-14 Select machine in the global database to link local machine to

The list of machines in the right pull down field represents only the machines in the global database which are not linked to any local machine. When one is selected the location information including all names is shown in the field on the lower right side of the screen.
Press 'CREATE LINK'. The Console will check whether the ISO descriptions of both local and global machine match. If this is not the case, a link will not be created:

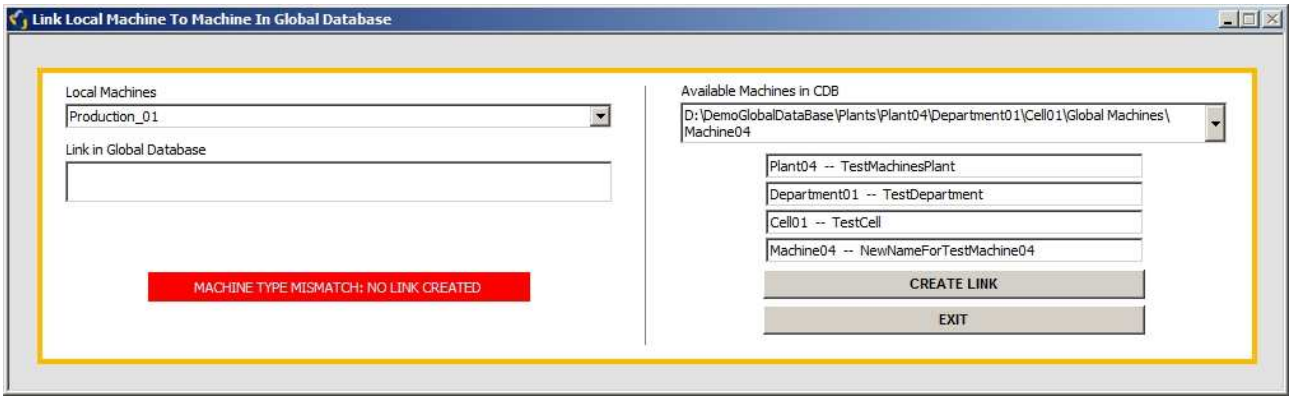


Figure 6-15 Machine type mismatch

If both ISO descriptions do match, the link will be created and an automatic synchronization between both machines will be executed:

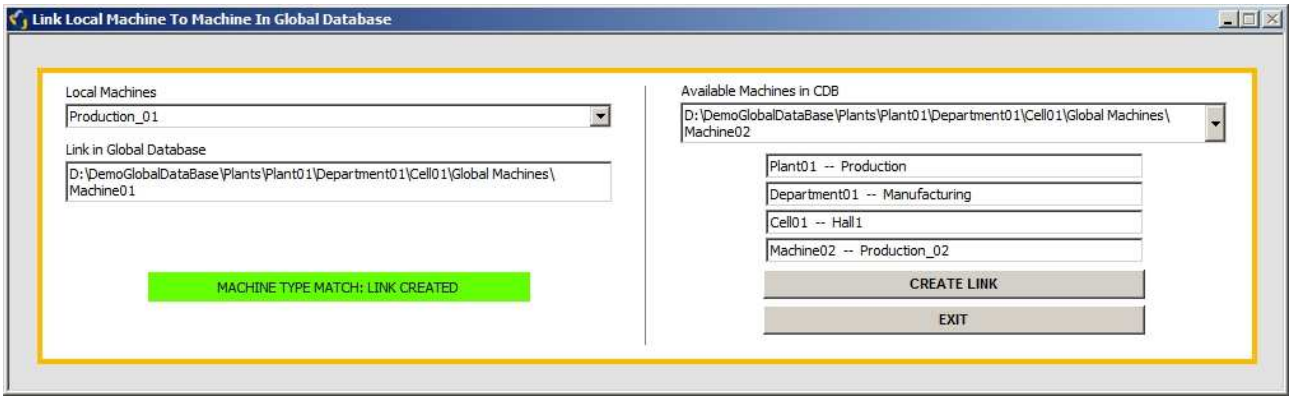


Figure 6-16 Machine type match

Press 'EXIT' to return to the 'Settings' section.

6.2.6 Synchronize with Global Database

Press the ‘SYNCHRONIZE WITH GLOBAL DATABASE’ button will synchronize only the selected local machine with its linked global machine.

This option is useful when more than one computer/laptop is used to perform the measurements with. While each computer has its own copy of the local machine linked to the same machine in the global database, the measurement history will be shared among these computers through the synchronization. The measurement reports however, will only be uploaded in the global database and can be selected from the RI Data Manager only.

Appendix A Database

A.1 Database

The central database is a structure of directories and files which contain the setup, configuration parameters and measurement data performed by inspector packages.

Note: For a correct operation of the Console it is not permitted to change, move or delete (parts of) this structure in any way.

Figure A-1: Database structure

The tree is built up as follows:

The three .ini files contain only the names of the artefacts, machines and Trinity probes respectively.

The ‘Machines’ directory contains one directory for each machine which, in turn, contains a ‘Measurements’ directory which is related to the given machine only. The database directory structure opened looks like:

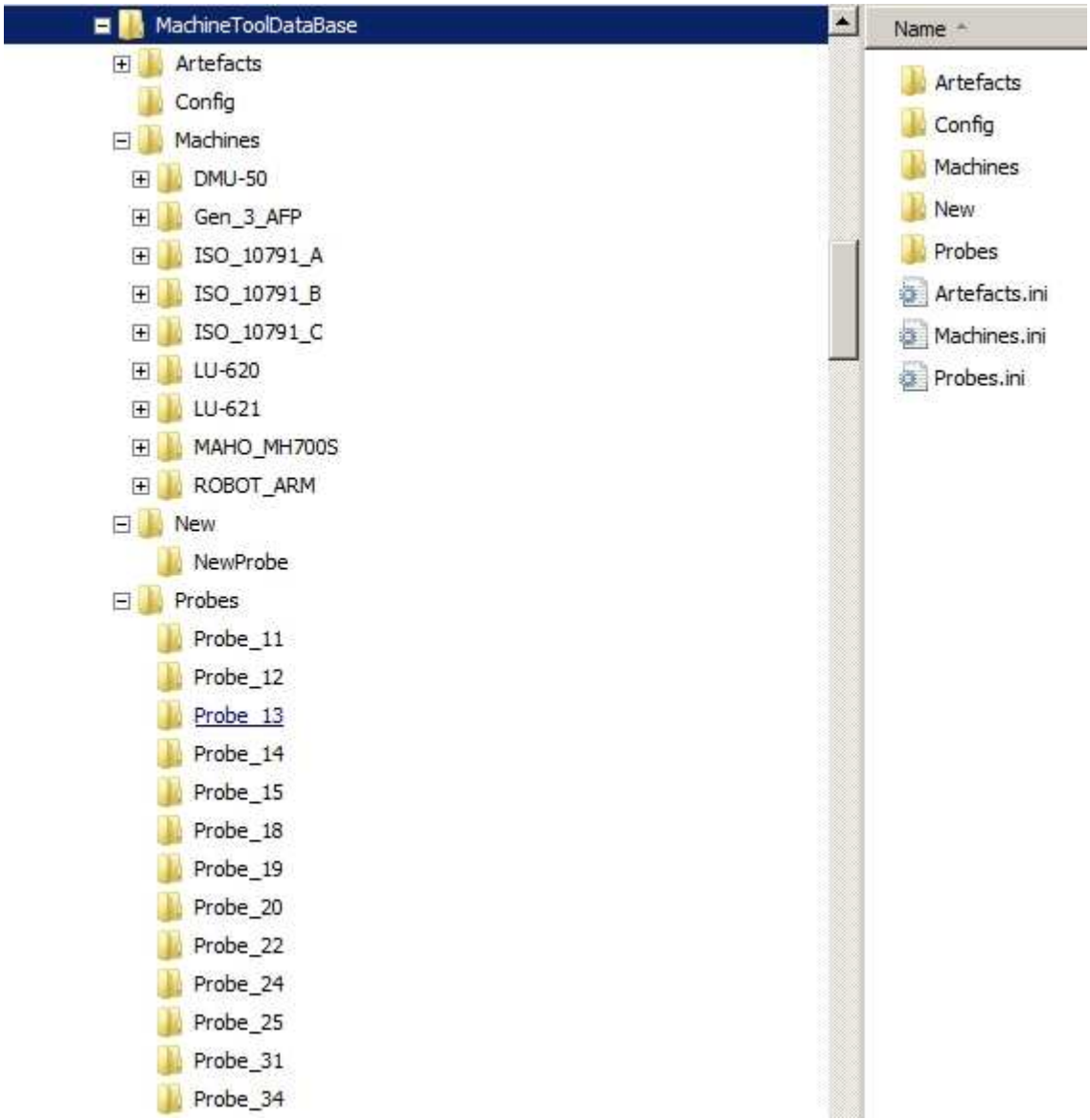


Figure A-2: Database structure opened

When a new Trinity measuring head or an existing Trinity measuring head calibration is added, the installer copies this file in the ‘New\NewProbe’ directory. The Console program moves this file to the appropriate directory along with its configuration settings automatically.

- A new measuring head calibration overwrites the old one in the existing directory.
- The calibration file of a new measuring head is placed into a newly created Trinity probe directory, leaving older existing Trinity probe directories untouched.

A.2 ConsoleConfig.ini file

The ‘ConsoleConfig.ini’ file which contains the data which is exchanged between the Console and the selected application is as follows:

[GENERAL INFO]
DB_Location = "/C/Program Files (x86)/IBS Precision Engineering/MachineToolDataBase"
SelectedProbe = "Probe_34"
SelectedMachine = "LU-620"
SelectedMeasurement = "PI_03_Balls"
SelectedArtefact = "BB_UMTK_1619_june2010"
NW_Adapter = "NETGEAR WNDA3100v2 N600 Wireless Dual Band USB Adapter"
NW_Adapter_GUID = "2614341687_41530_19167_163_200_237_7_27_208_76_79"
NW_Profile = "TRINITY_001_0034"
Xbee_Vs_S6B = 0
Probe_Available = 1

Where:

1. DB_Location is the location of the database directory structure;
2. SelectedProbe is the current wireless ‘Trinity’ measuring head and refers to the directory name which is, in turn, part of the ‘probes’ directory. In this ‘Probe_xx’ directory a configuration file is read which contains all network settings for this particular probe;
3. SelectedMachine is the current machine on which measurements will be performed;
4. SelectedMeasurement is the current measurement which will be performed;
5. SelectedArtefact is only used by the ‘Position Analyzer’ and will further be ignored;
6. NW_Adapter is the description of the type name of the used network adapter, this is NOT a user given name;
7. NW_Adapter_GUID is the ID number of the network adapter which is set in the hardware, windows uses this number for network adapter identification. The Console software needs this number in order to be able to call the adapter for signal strength information;
8. NW_Profile is the current network profile the Console software uses to set and load the network profile in windows;
9. Xbee_Vs_S6B is the version number of the wireless interface inside the wireless probe. Currently, there are two different types of wireless interfaces for the probe: version ‘S6’ and the newer version ‘S6B’. The Console software has to determine which version is contained in the current probe because the command set used to control this interface is different in both versions;
10. When the wireless probe is available and recognized in the system this value is set to ‘1’ and the applications can work with the wireless probe to perform measurements. Otherwise, when the probe is not available and/or recognized in the system, the applications can still be called and used for analytical purposes if available. Obviously, measurements cannot be performed in this mode and this value is set to ‘0’.

This information is initially read by the Console at startup and shown on the screen as the previous setting. When all desired selections are made and the application (e.g. Position Inspector) is started, this data is written to this file BEFORE the application starts.
The application reads this data at startup and the appropriate settings for machine, measurement and probe are retrieved from the various locations in the database to make an instant correct measurement possible.

Appendix B Operation in a ´.local´ domain

Introduction

In some cases the domain is setup as a ".local" network. There is a known compatibility issue with this domain and a component required by the National Instrument runtime engine, which is installed by the Console software.

Problem

A subcomponent of NI products may cause unexpected behavior when installed on Windows machines located on a .local domain.

Two main behaviors have been observed:

- Longer than normal boot times (around 20 minutes);
- Screen blacks out and becomes unresponsive after entering log-on credentials.

Identification

When running the setup program an automatic check for a .local domain is performed. If it is found a warning is issued. At the end of the installer, a batch file supplied by National Instruments, which solves this issue, is always executed.

To verify your domain right-click **Computer** and select **Properties** from the shortcut menu. Look under "**Computer name, domain, and workgroup settings**" and check the "**domain**".
If it contains .local the unexpected behavior may occur.

Solution 1

If the unexpected behavior still occurs please run the **disable_nsp.bat** which can be found on the setup cd. Make sure to run it as an administrator.

Figure B-1: Running 'disable_nsp.bat'.

Solution 2

If the unexpected behavior still occurs after running disable_nsp.bat please do the following:

Start **regedit** through the windows start menu:

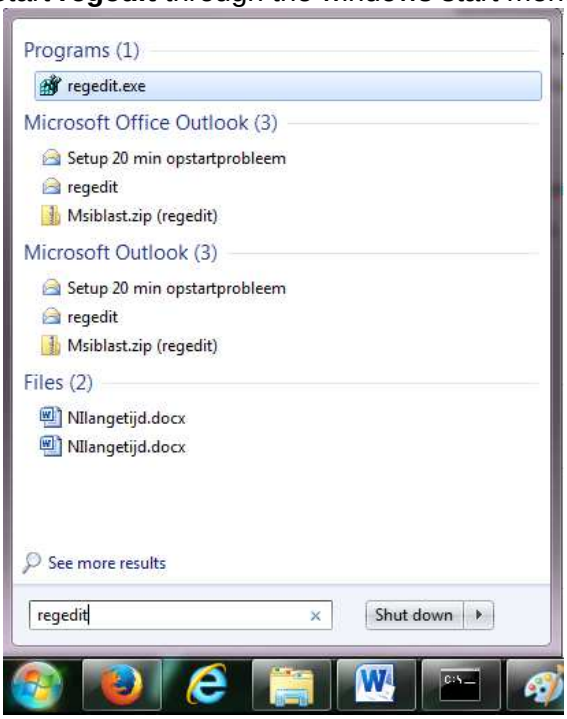


Figure B-2: Start regedit.

Scroll to the following keys:

HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\services\WinSock2\Parameters\NameSpace_Catalog5\Catalog_Entries

Figure B-3: Contents windows registry.

Find the key **nimdnsNSP**. This is usually the last number in the list.

Set the "**Enabled**" value data to 0.

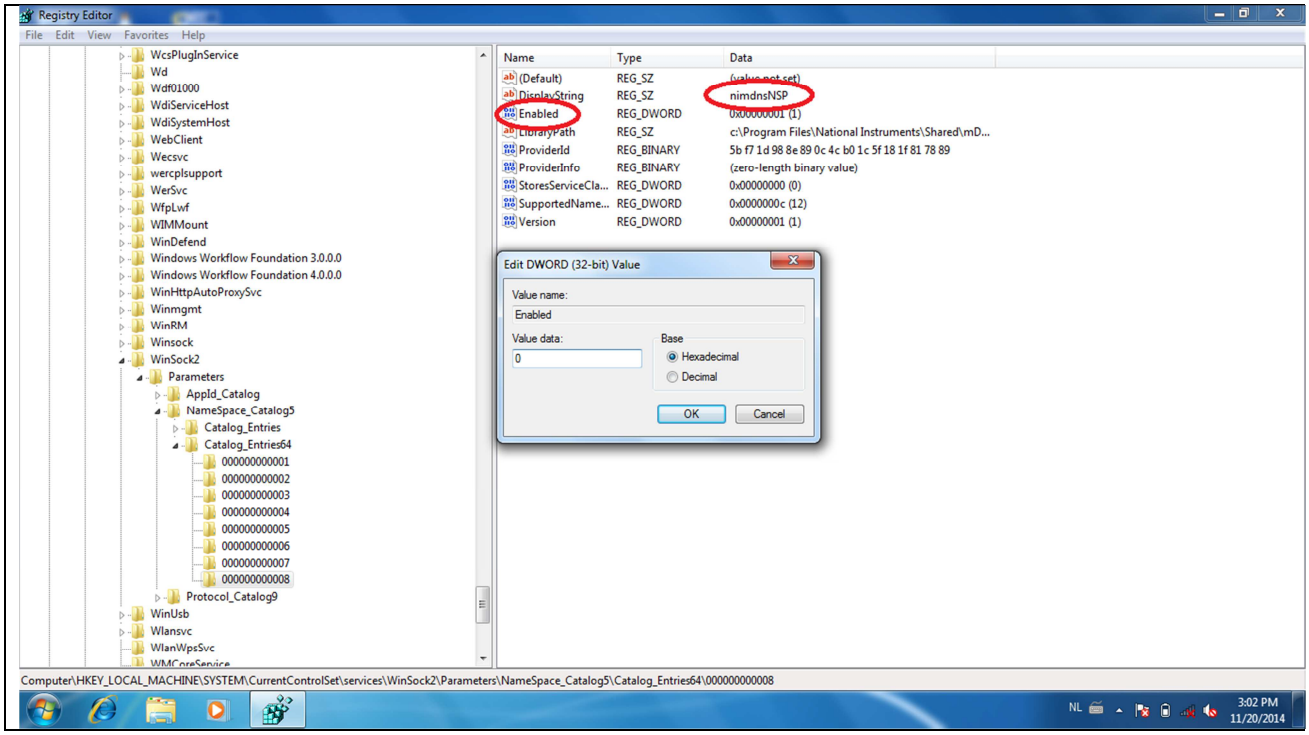


Figure B-4: Editing windows registry.

If the key Catalog_Entries 64 exists:

HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\services\WinSock2\Parameters\Name Space_Catalog5\Catalog_Entries64

Then repeat the procedure; Find the key nimdnsNSP, and set the **"Enabled**" value data to 0.

Appendix C Password

The password used to log into the ‘Settings’ and the database is by default:

‘**welcome**’

Without the quotes and is set at installation. This password can/may be changed; for an explanation see section 4.2.2.

Appendix D Output definition parameters

D.1 Overview Rotary

D.1.1 Rotary Analyzer (RA)

Output	Description	Definition in ISO
	Tabsheet Processed (the second)	
XOC	Pivot point correction of C-axis in X direction in mm	XOC
YOC	Pivot point correction of C-axis in Y direction in mm	YOC
AOC	Squareness error between C-axis and Y-axis (C-axis is rotated along X-axis). Variation in Z of least squares straight line fit in the YZ-plane in mm	AOC (Radius needed for squareness angle)
BOC	Squareness error between C-axis and X-axis (C-axis is rotated along Y-axis). Variation in Z of least squares straight line fit in the XZ-plane in mm	BOC (Radius needed for squareness angle)
XOB	Pivot point correction of B-axis in X direction in mm	XOB
ZOB	Pivot point correction of B-axis in Z direction in mm	ZOB
AOB	Squareness error between B-axis and Z-axis (B-axis is rotated along the X-axis) Variation in Y of least squares straight line fit in the YZ – plane in mm	AOB (Radius needed for squareness angle)
COB	Squareness error between B-axis and X-axis (B-axis is rotated along the Z-axis) Variation in Y of least squares straight line fit in the XY – plane in mm	COB (Radius needed for squareness angle)
YOA	Pivot point correction of A-axis in Y direction in mm	YOA
ZOA	Pivot point correction of A-axis in Z direction in mm	ZOA
BOA	Squareness error between A-axis and Z-axis (A-axis is rotated along the Y-axis) Variation in X of least squares straight line fit in the XZ – plane in mm	BOA (Radius needed for squareness angle)
COA	Squareness error between A-axis and Y-axis (A-axis is rotated along the Z-axis) Variation in X of least squares straight line fit in the XY – plane in mm	COA (Radius needed for squareness angle)
	Tabsheet Raw (the first)	
S_x	Measured deviation in X direction in mm	$S_{x,xyzbc}$
S_y	Measured deviation in Y direction in mm	$S_{y,xyzbc}$
S_z	Measured deviation in Z direction in mm	$S_{z,xyzbc}$
ACT-	Minimum XYZ measurement in mm	n.a.
ACT+	Maximum XYZ measurement in mm	n.a.
Q-value	The maximum variation measured (=ACT+ minus ACT-)	n.a.

D.1.2 Rotary Inspector (RI)

Output	Description	Definition in ISO
Q-value	The maximum variation measured (=ACT+ minus ACT-)	n.a.
S_x	Measured deviation in X direction in mm	$S_{x,xyzbc}$
S_y	Measured deviation in Y direction in mm	$S_{y,xyzbc}$
S_z	Measured deviation in Z direction in mm	$S_{z,xyzbc}$
XOC	Pivot point correction of C-axis in X direction in mm	XOC
YOC	Pivot point correction of C-axis in Y direction in mm	YOC
XOB	Pivot point correction of B-axis in X direction in mm	XOB
ZOB	Pivot point correction of B-axis in Z direction in mm	ZOB
YOA	Pivot point correction of A-axis in Y direction in mm	YOA
ZOA	Pivot point correction of A-axis in Z direction in mm	ZOA

D.2 Overview Linear

D.2.1 Position Analyzer (PA)

Output	Description	Definition in ISO
EXX A	Linearity; Accuracy X-axis in mm	EXX A
EXX B	Linearity; Backlash in mm	EXX B
EXX E	Linearity; Systematic Positional Deviation in mm	EXX E
EXX M	Linearity; Mean Positional Deviation in mm	EXX M
EXX R	Linearity; Repeatability of positioning in mm	EXX R
EYX	Straightness error X-axis in Y direction in mm	EYX
EZX	Straightness error X-axis in Z direction in mm	EZX
EYY A	Linearity; Accuracy Y-axis in mm	EYY A
EYY B	Linearity; Backlash in mm	EYY B
EYY E	Linearity; Systematic Positional Deviation in mm	EYY E
EYY M	Linearity; Mean Positional Deviation in mm	EYY M
EYY R	Linearity; Repeatability of positioning in mm	EYY R
EXY	Straightness error Y-axis in X direction in mm	EXY
EZY	Straightness error Y-axis in Z direction in mm	EZY
EZZ A	Linearity; Accuracy Z-axis in mm	EZZ A
EZZ B	Linearity; Backlash in mm	EZZ B
EZZ E	Linearity; Systematic Positional Deviation in mm	EZZ E
EZZ M	Linearity; Mean Positional Deviation in mm	EZZ M
EZZ R	Linearity; Repeatability of positioning in mm	EZZ R
EXZ	Straightness error Z-axis in X direction in mm	EXZ
EYZ	Straightness error Z-axis in Y direction in mm	EYZ

D.2.2 Position Inspector (PI)

Output / Ball	Description	Definition in ISO
Deviation X	Deviation in X w.r.t. reference measurement in µm	n.a.
Deviation Y	Deviation in Y w.r.t. reference measurement in µm	n.a.
Deviation Z	Deviation in Z w.r.t. reference measurement in µm	n.a.

Appendix E Hardware

The Machine Tool Console measurement system is supplied in a travel case containing, see Figure :

1. Trinity measuring head;
2. D-Link Access Point (switch in Router/AP position);
3. NetGear Wireless USB Adapter;
4. Four batteries;
5. Battery charger & adapter;
6. Master ball 75mm;
7. Extension rods for Master ball;
8. Tool setter ball with M4 fine thread;
9. Mounting magnet with M8 thread hole;
10. Two Allen keys, size 4 mm.

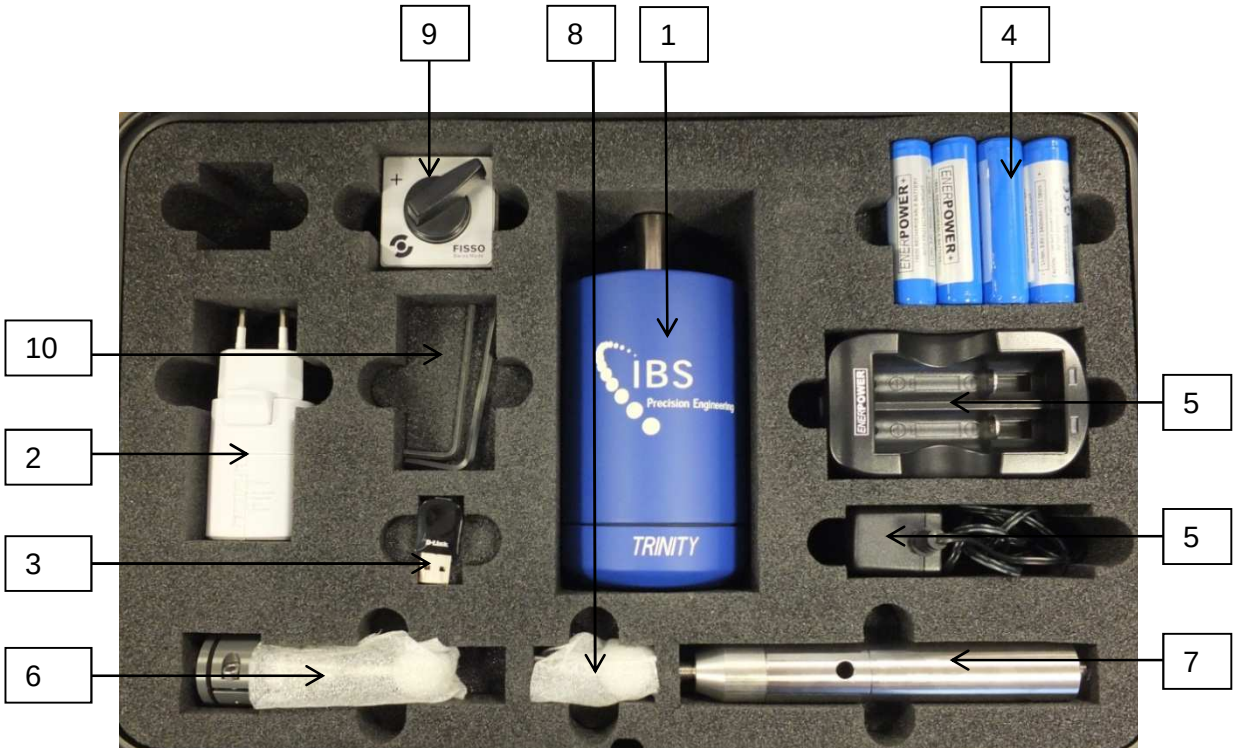


Figure E-1: Content of Trinity travel case.

Default this system is supplied with a euro plug. Contact IBS Precision Engineering if another plug type is required.

Warning: The Trinity measuring head is a precision measurement instrument and should be treated as such. Handle the Master ball and tool setter ball with great care.

Specifications of the Trinity measuring head system:

Roundness error Master ball:	< 0.6 µm
Nominal diameter of Master ball:	22 mm
Length Master ball:	75 mm

Measuring head:

Measurement uncertainty of TP-001:	U_{1d} < 1.5 µm (full range) U_{1d} < 1 µm (within 1 mm range)
Measurement range:	3.50 mm
Power consumption (idle/measure/sleep):	1W (21.5 hrs.) / 1.3W (17 hrs.) / 0.52 W (42 hrs.)

Wireless specifications:

Operating frequency:	2.4 GHz
Standard:	802.11b/g/n
Security:	WPA2-PSK (only in access point mode)
Regulatory Approvals of Wireless module:	FCC, IC, CE/ETSI, C-TICK, TELEC

Supplied:

- Manual Console software manual(this document);
- Calibration certificate measuring head;
- Application install DVD including the Console software;
- Measuring head calibration file installer DVD;

The Trinity is provided with LEDs on both sides and these have 4 modes of operation:

1. Constantly lit of one of two sides
   System is on, but not associated with a wireless network;
2. Slow flashing (1 second interval)
   System is on and associated with a wireless network;
3. Flashing (0.2 second interval)
   System is on and streaming data;
4. Very slow flashing (2 second interval)
   System is asleep.

The red LED lights up when the battery has approximately 1 hour of measurement time remaining. It is advised to replace the batteries when this LED becomes active.

Appendix F Troubleshooting

- The Console application is by default set to run as administrator and will be added as a rule to the windows firewall at first run. If that fails please make sure you are administrator or have full administrative rights.

- If the Console application is to be run from a standard user account without the necessary administrative rights, the application must be started using a specific configured shortcut which takes care of these administrator issues. Detailed instructions how to set up this shortcut are given in appendix G.

- If your system has an additional firewall (other than windows) please consult the manual of that firewall to allow access for the software packages. All packages must be allowed to write and read for UDP and TCP protocols.

Appendix G Using the application in a standard user account

To be able to run, the Trinity software requires administrative rights. Running the software from a standard windows user account requires a special shortcut which takes care of these administrative requirements without prompting for the administrator password.

This specially configured shortcut has to be setup in the built-in administrator account which must therefore be enabled and set with a password. Creating the shortcut using other defined administrator accounts will fail.

G.1 Enable built-in administrator account

The built-in administrator account is by default disabled and not password protected in windows and must therefore be enabled first. A password must also be set. The following description will show how to check the enabled state and the setting of the password of the administrator account.

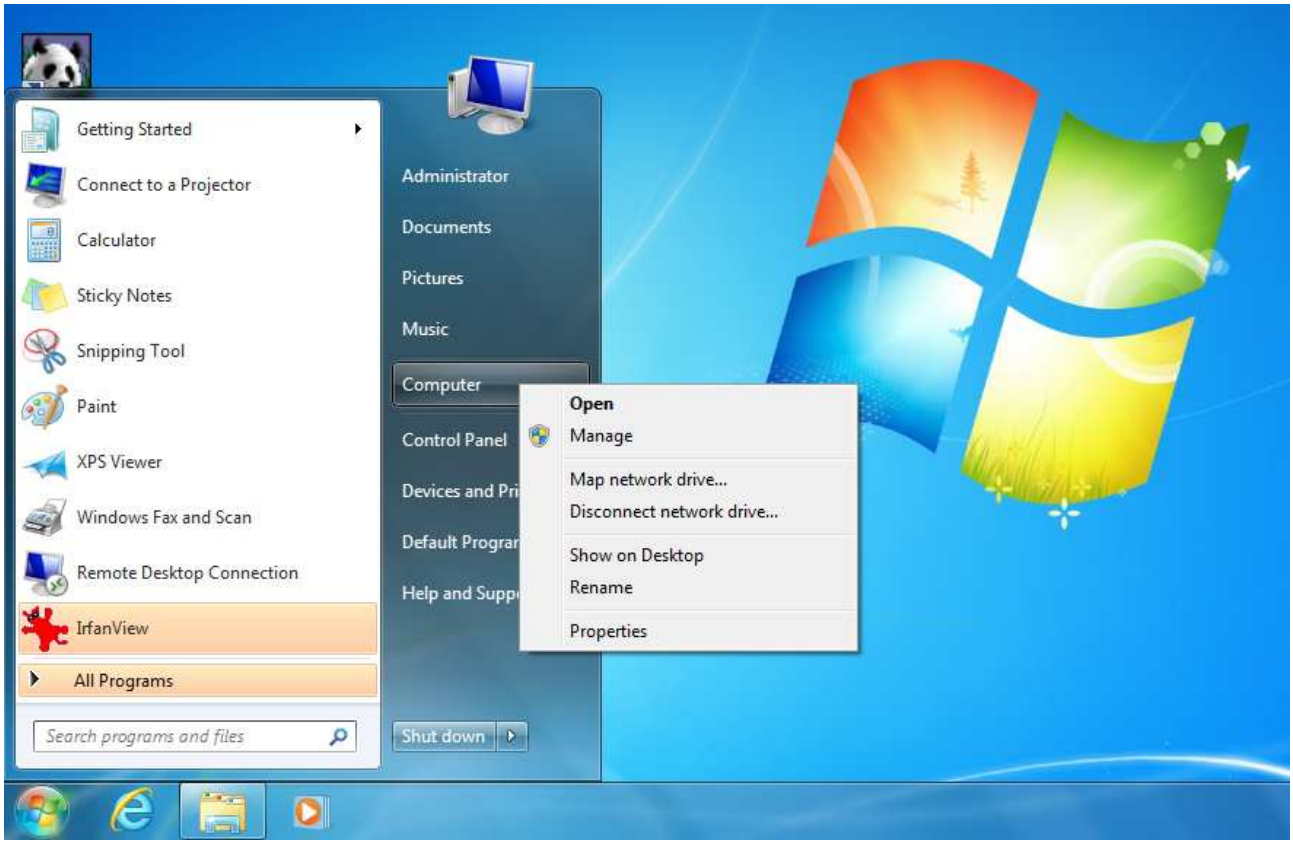


Figure G-1 Select Computer Manager

See figure G-1: click “Start”, right click “Computer” and select “Manage”. In the following screen, select “Local Users and Groups” and open the “Users” folder. Right click on “Administrator” and select “Properties” (Fig. G-2):

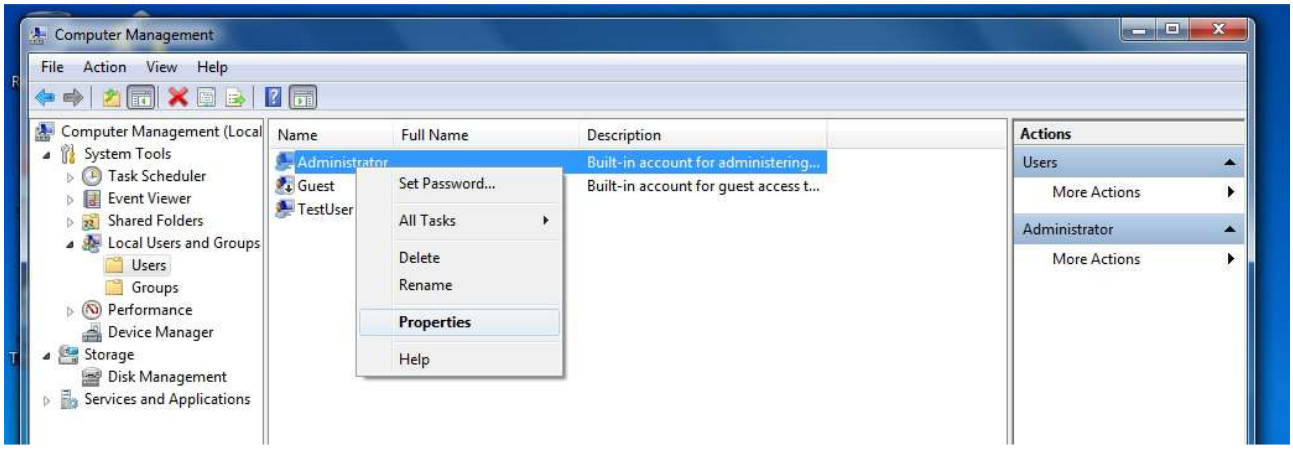


Figure G-2 Select administrator properties

In the administrator properties make sure the “Account is disabled” option is **unchecked** (see figure G-3):

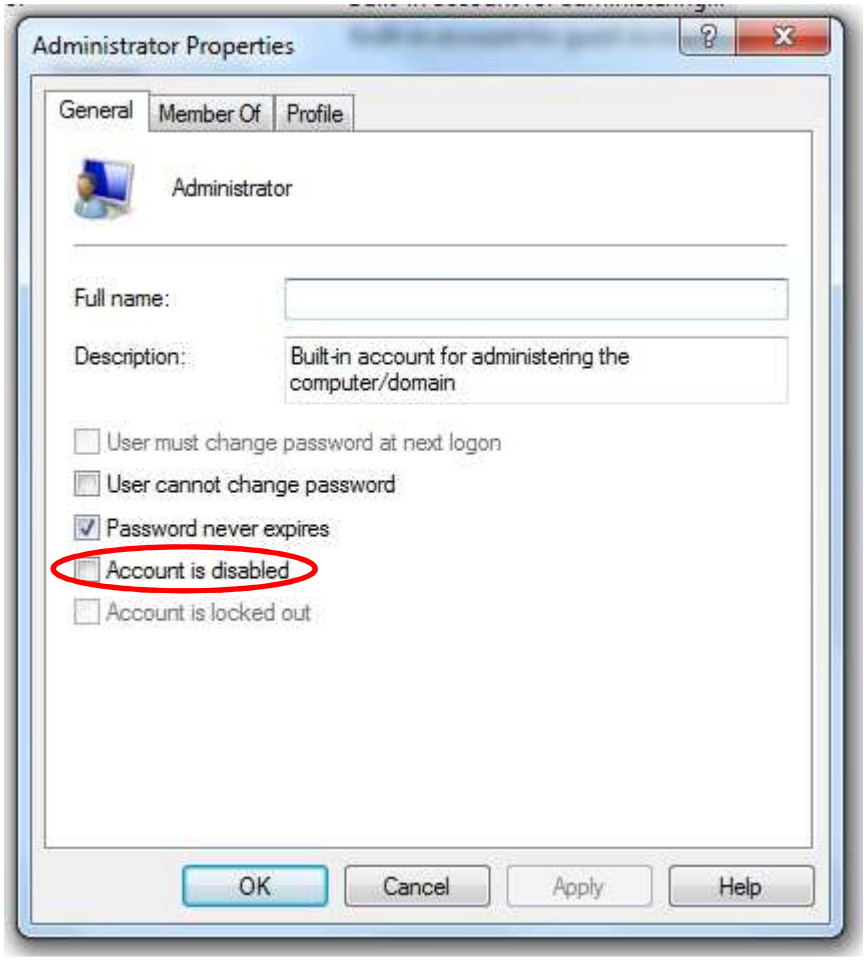


Figure G-3 Enable administrator account

When any changes are made, the “Apply” button becomes active. Press “Apply” (only when active) and “OK” to return to the screen shown in figure G-2.

Right click on “Administrator” again and select “Set Password…”, the following message appears:

Figure G-4 Proceed to set password

Click “Proceed” to the following screen:

Figure G-5 Set password

Enter a unique password in both fields and press “OK”. If both fields are filled with an identical name the following message appears:

Figure G-6 Password set successfully

Press “OK” twice and close the computer management screen.

G.2 Get the computer name

In order to be able to set the administrator credentials (section G.3) and create the special shortcut (section G.4), the computer name must be available. If the computer name is unknown, it can be found in the control panel:

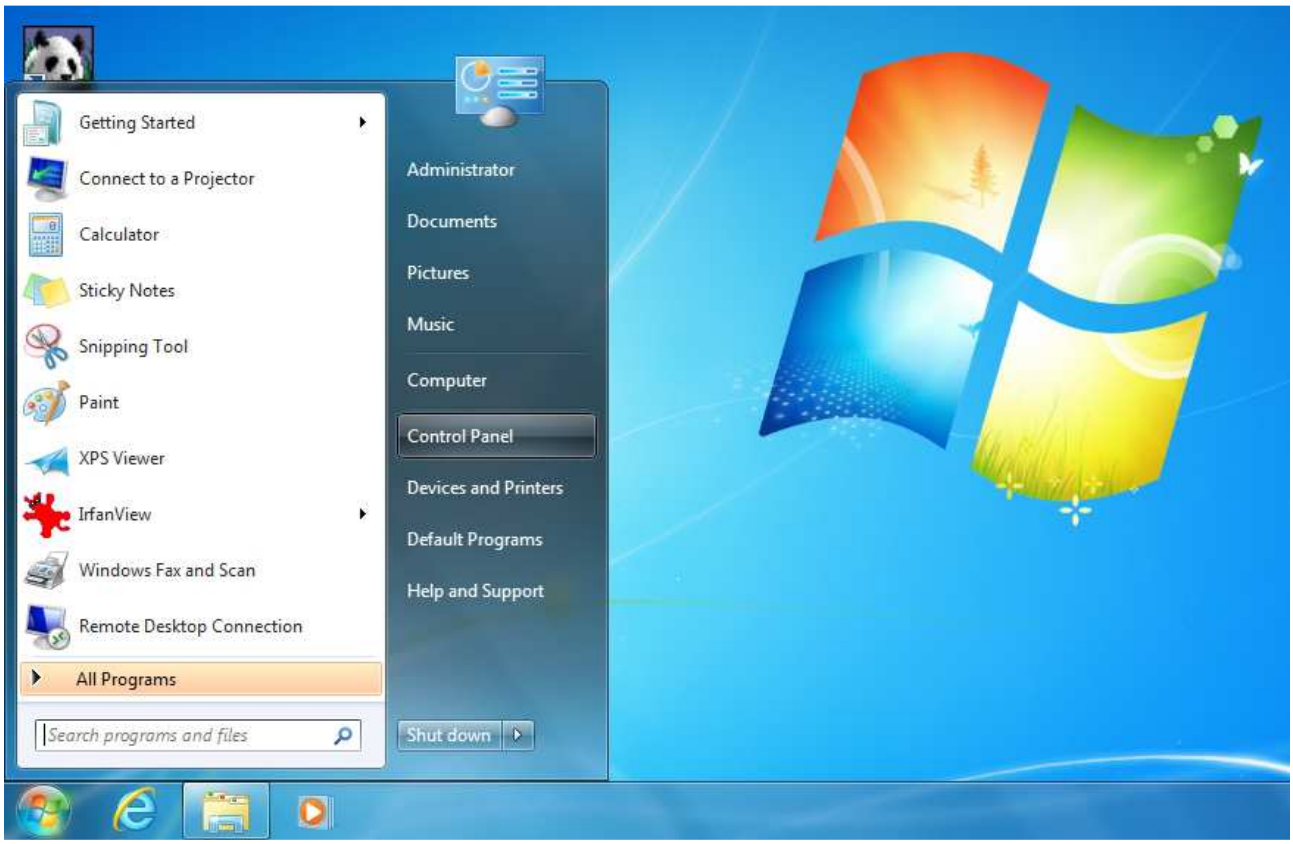


Figure G-7 Select Control Panel

On the control panel, select “System and Security”. In the “System” item select “See the name of this computer” (Fig. G-8):

Figure G-8 See the name of this computer

On the following screen the computer name can be found (Fig. G-9):

Figure G-9 Computer name

Save the computer name and close the control panel.

G.3 Set administrator credentials

Back on the desktop press “Start” and select the “Control Panel”:

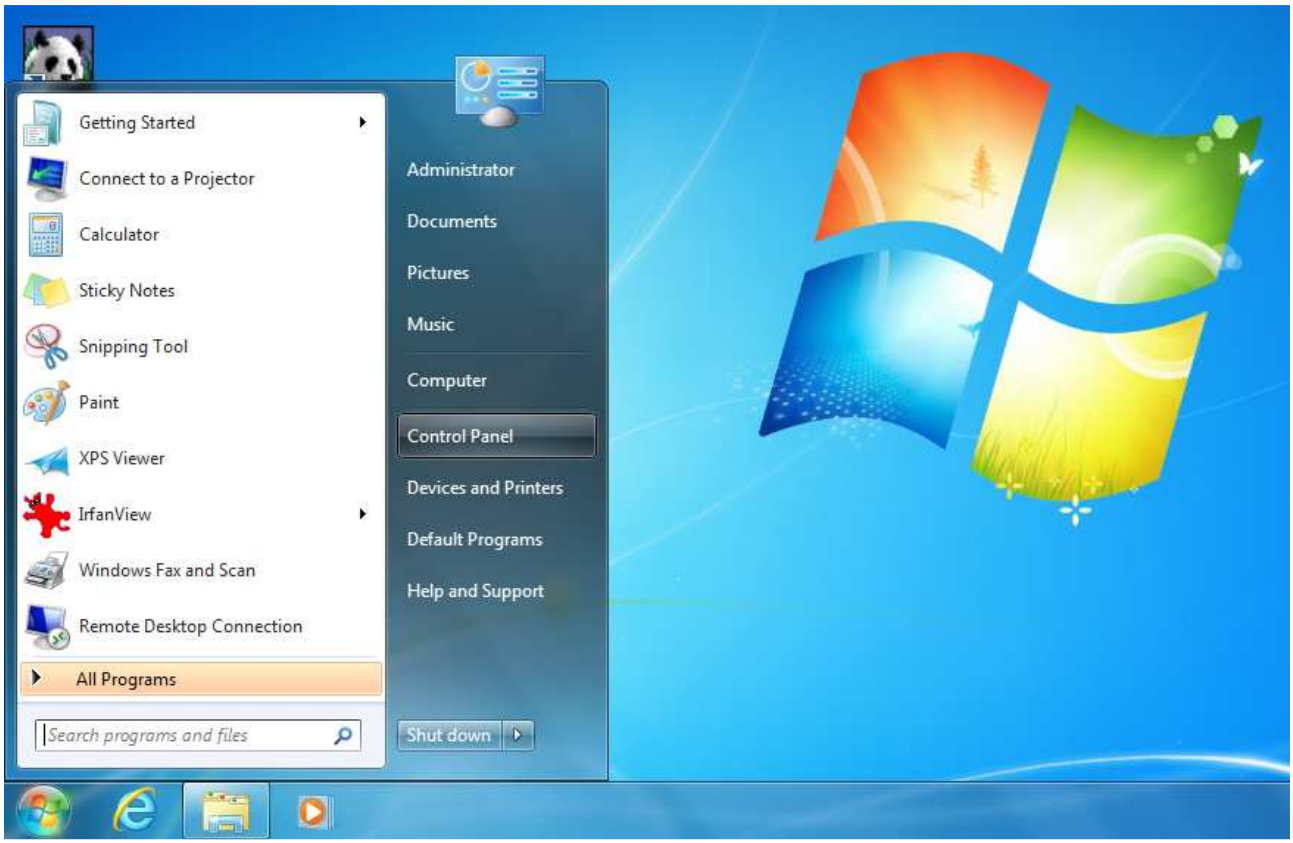


Figure G-10 Select Control Panel

The “Control Panel” appears:

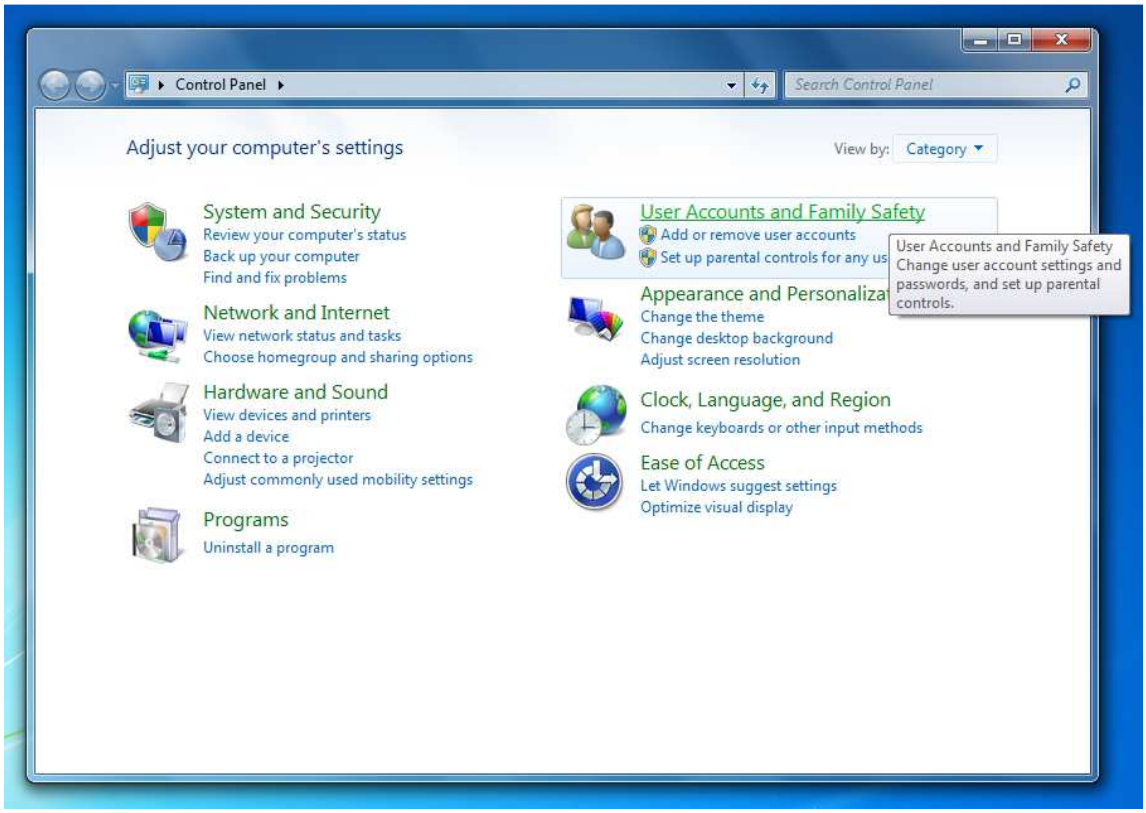


Figure G-11 Control Panel

See figure G-11: select “User Accounts and Family Safety” and open the “Credential Manager”:

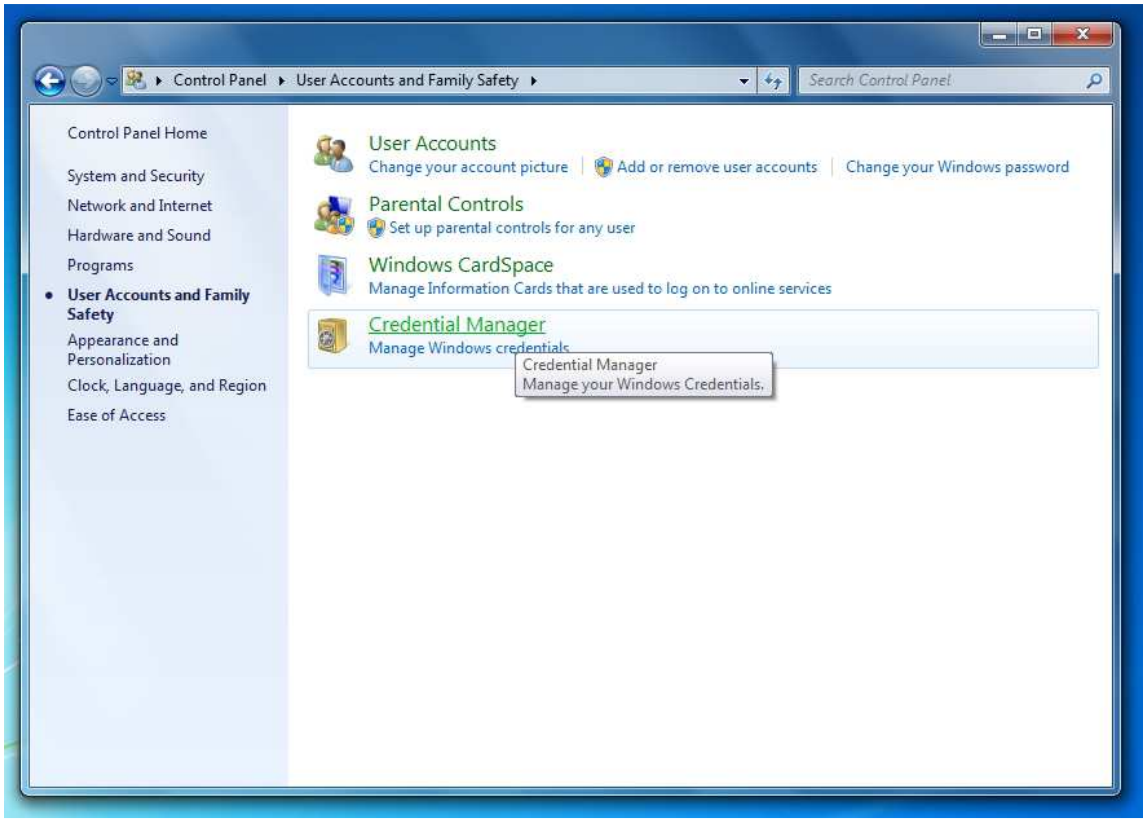


Figure G-12 Select Credential Manager

In the “Credential Manager” select “Add a Windows Credential”, the following input fields will appear:

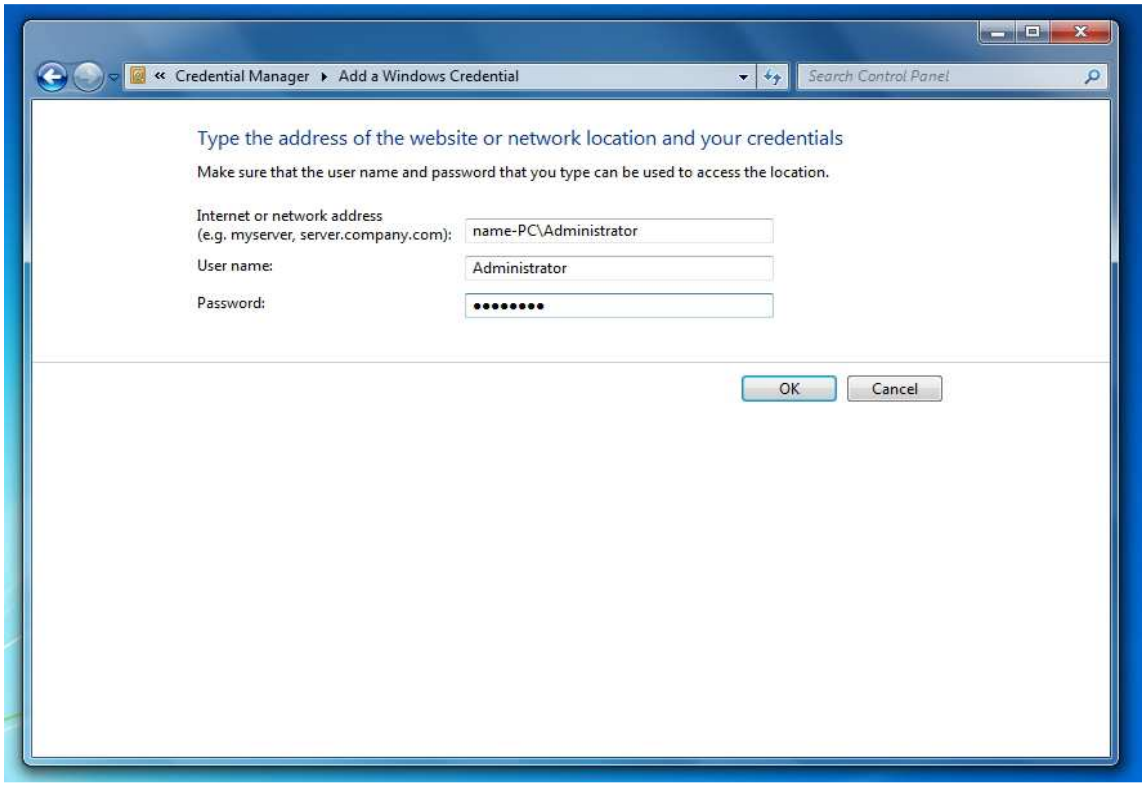


Figure G-13 Enter credentials

Fill the fields with the information as shown in figure G-13. The ‘Internet or network address’ contains the name of the PC followed by a backslash and “Administrator”, the ‘User name’ is “Administrator” and the ‘Password’ is the unique password entered in figure G-5 as shown above. Press “OK” when done.

The entries should look like the screen shown in figure G-14:

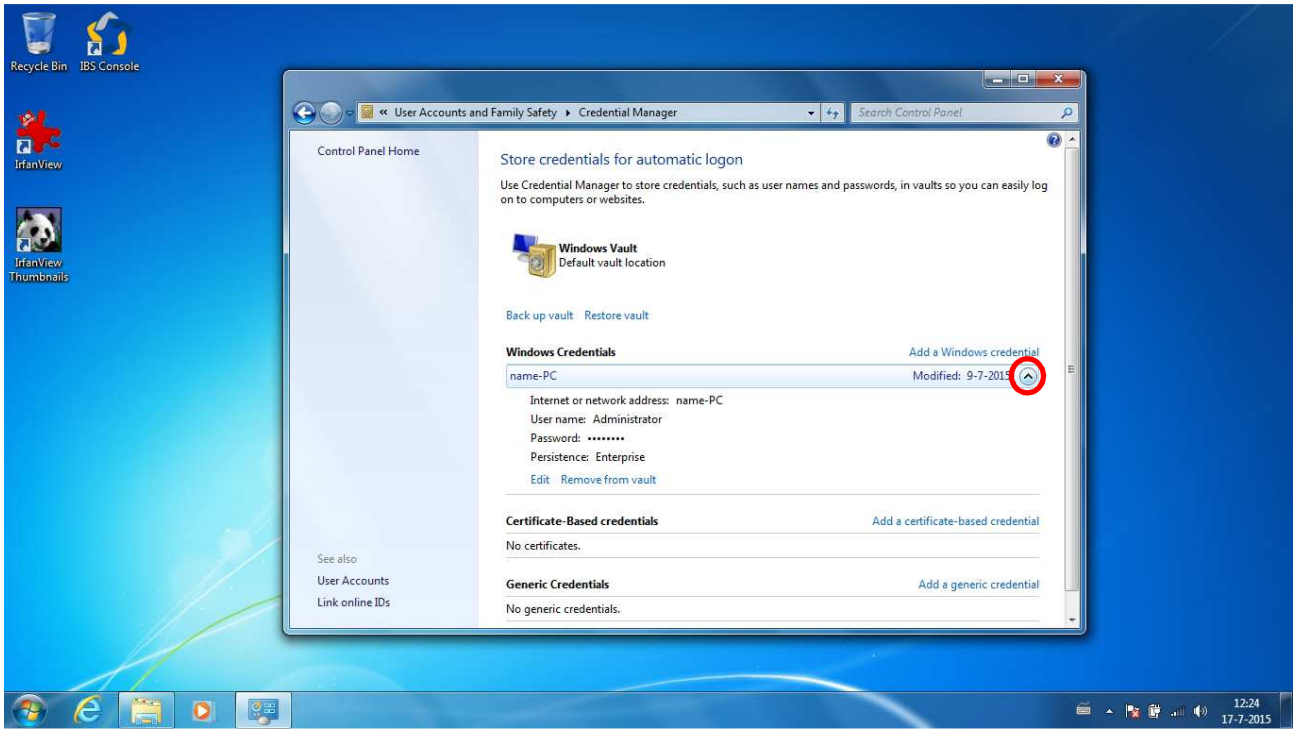


Figure G-14 Credentials after entering

Close the “Control Panel”.

G.5 Creating the special shortcut

Right click on the desktop, select “New” and “Shortcut”:

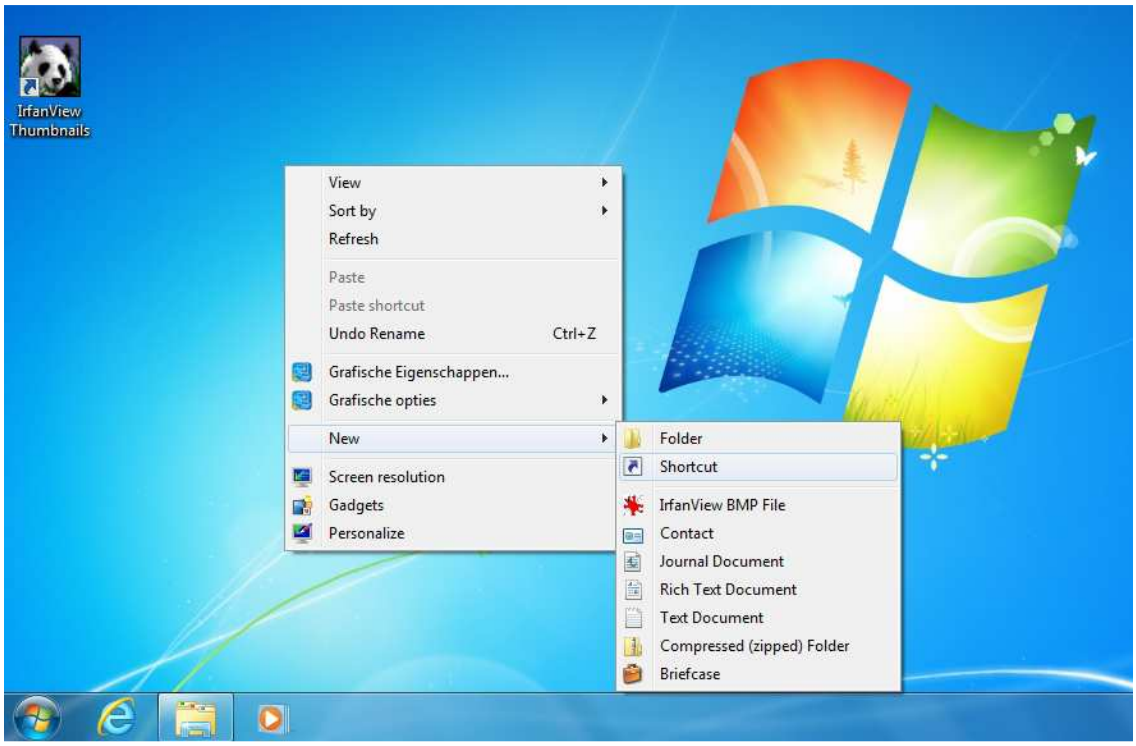


Figure G-15 Create new shortcut

The following screen appears:

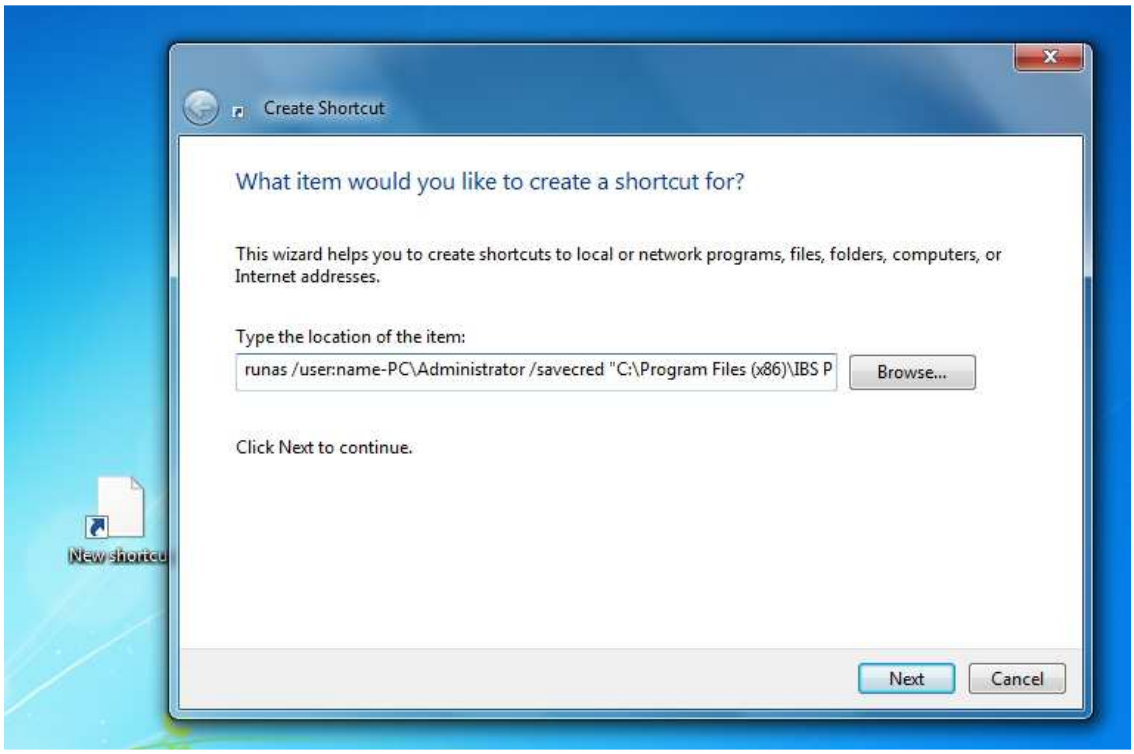


Figure G-16 Enter settings for shortcut

The easiest way to set up this shortcut: Right click on the desktop and select “New” and “Shortcut”. Use the “Browse…” button to select the ‘IBS_Console.exe’ application. In the location field the full path and name to the application appears:

“C:\Program Files (x86)\IBS Precision Engineering\IBS_Console.exe”

The following must be added **before** the file location:

runas /user:name-PC\Administrator /savecred

Notes:

1. ‘runas’ is followed by a space
2. ‘/savecred’ is followed by a space which in turn is followed by the full path and name of the application set at the beginning.

The result is shown in Fig. G-16 (where the last part of the setup is not visible caused by the field size).

When done, click “Next” and enter the name for the shortcut and click “Finish”:

Figure G-17 Enter name for shortcut

When finished, the shortcut icon will default to the “runas.exe” icon from Windows rather than the IBS Console icon. It is optional to set the icon back to the IBS Console. This may be executed as follows:

Right click the shortcut and select “Properties”:

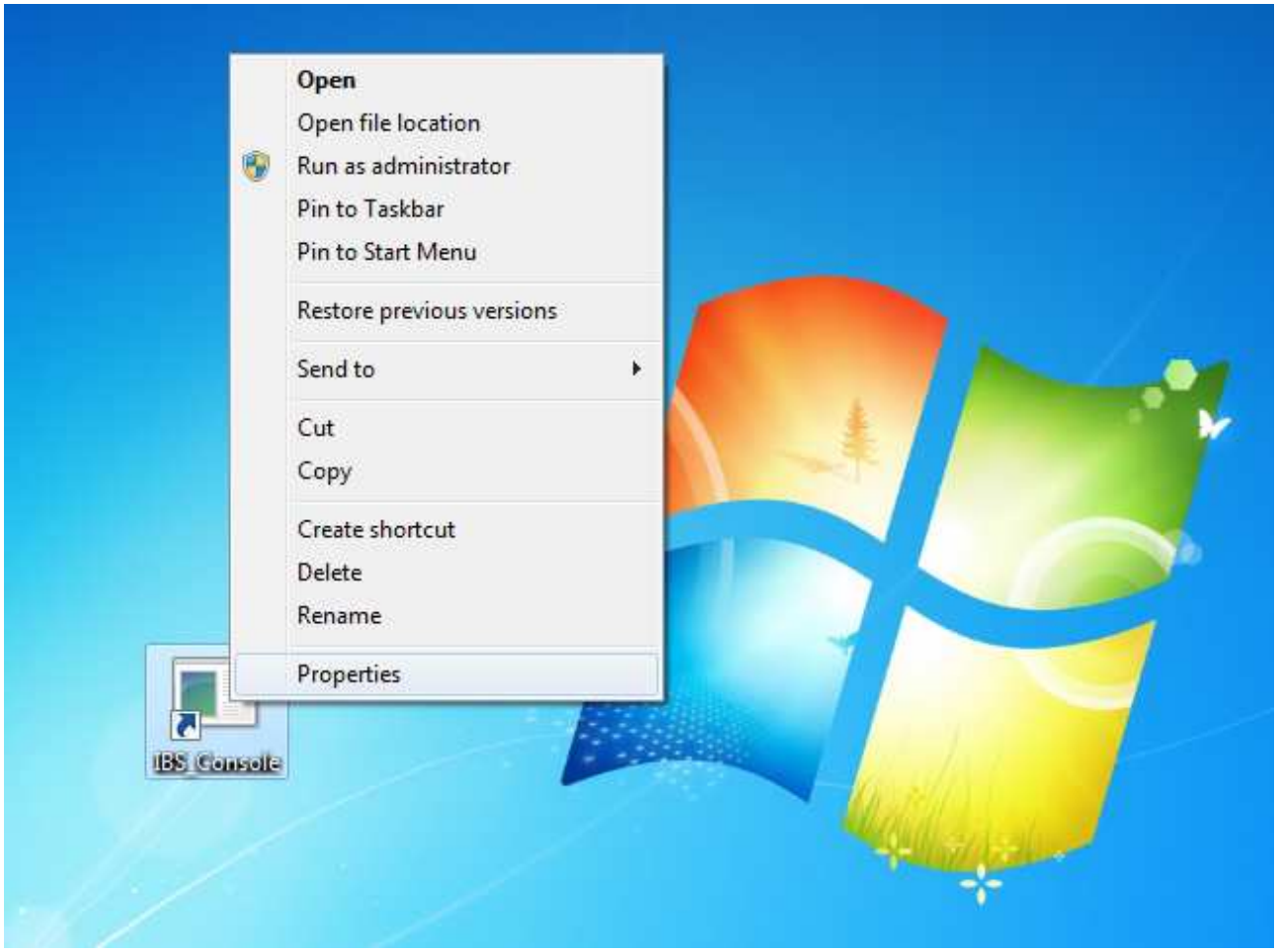


Figure G-18 Select shortcut properties

In the “Shortcut” Tab of the properties click “Change Icon…” which will show the “Change Icon” message shown in figure G-19:

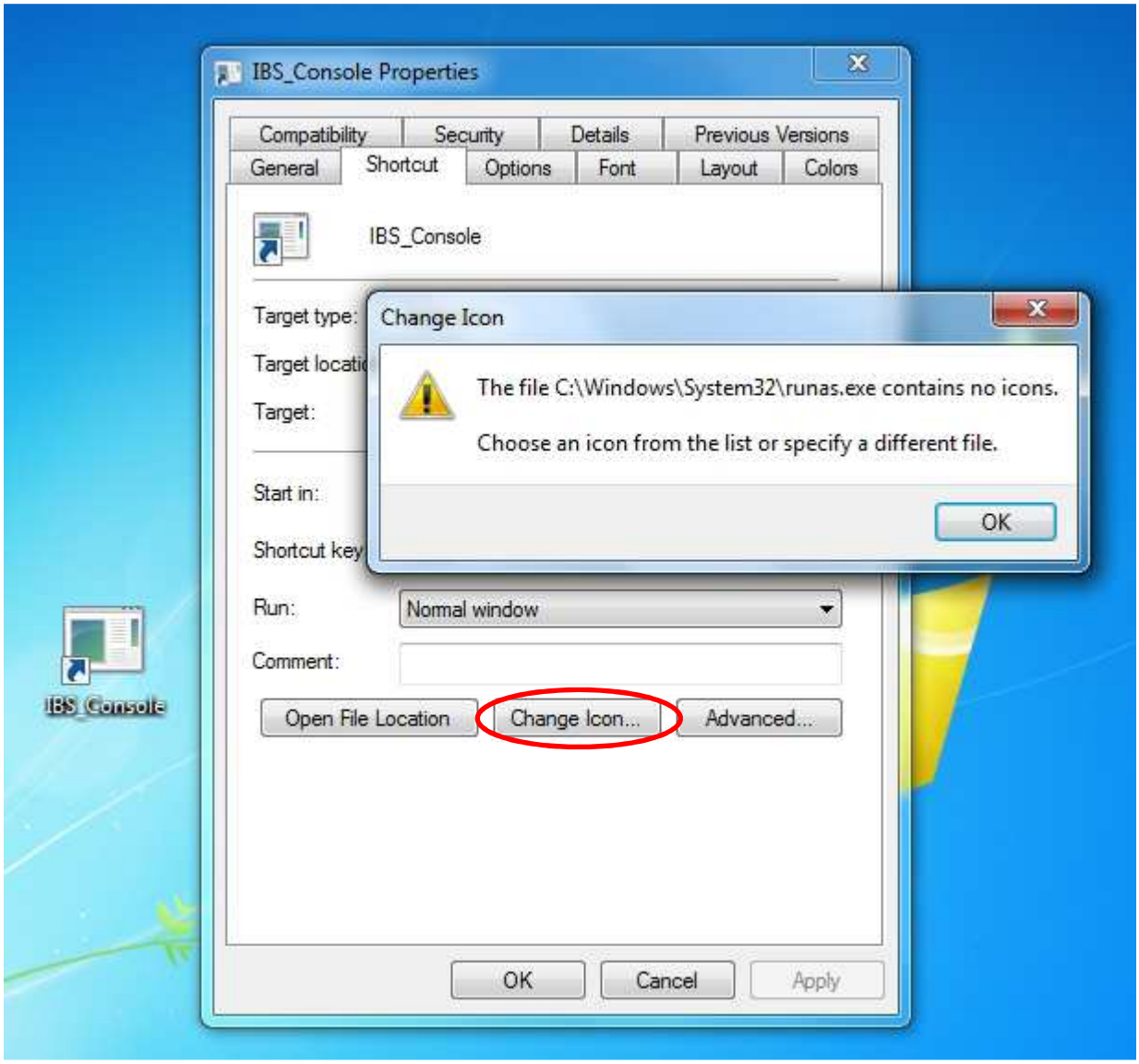


Figure G-19 Change icon

Click “OK” to open the screen containing the standard windows icons. Click “Browse…” and select the application that the shortcut is pointing to (in this case “IBS_Console.exe”):

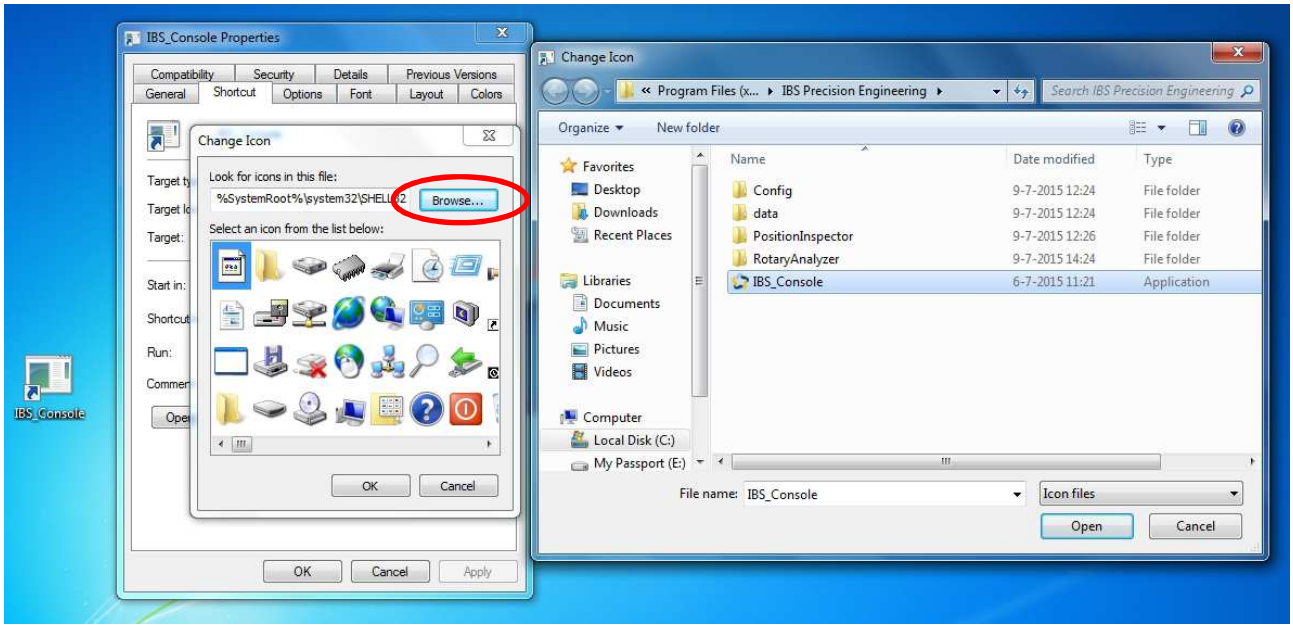


Figure G-20 Select correct icon

Click “Open”, “Apply” and “OK” to set the shortcut icon to the desired image.

G.6 Put the shortcut on the user desktop and activate

Once the shortcut is created on the administrator account's desktop, the shortcut needs to be copied to the desktop of the standard user.

To copy the shortcut to the user desktop, execute the following procedure:

Open Windows explorer and select "Users", the name of the standard user account (in this case "TestUser") and "Desktop":

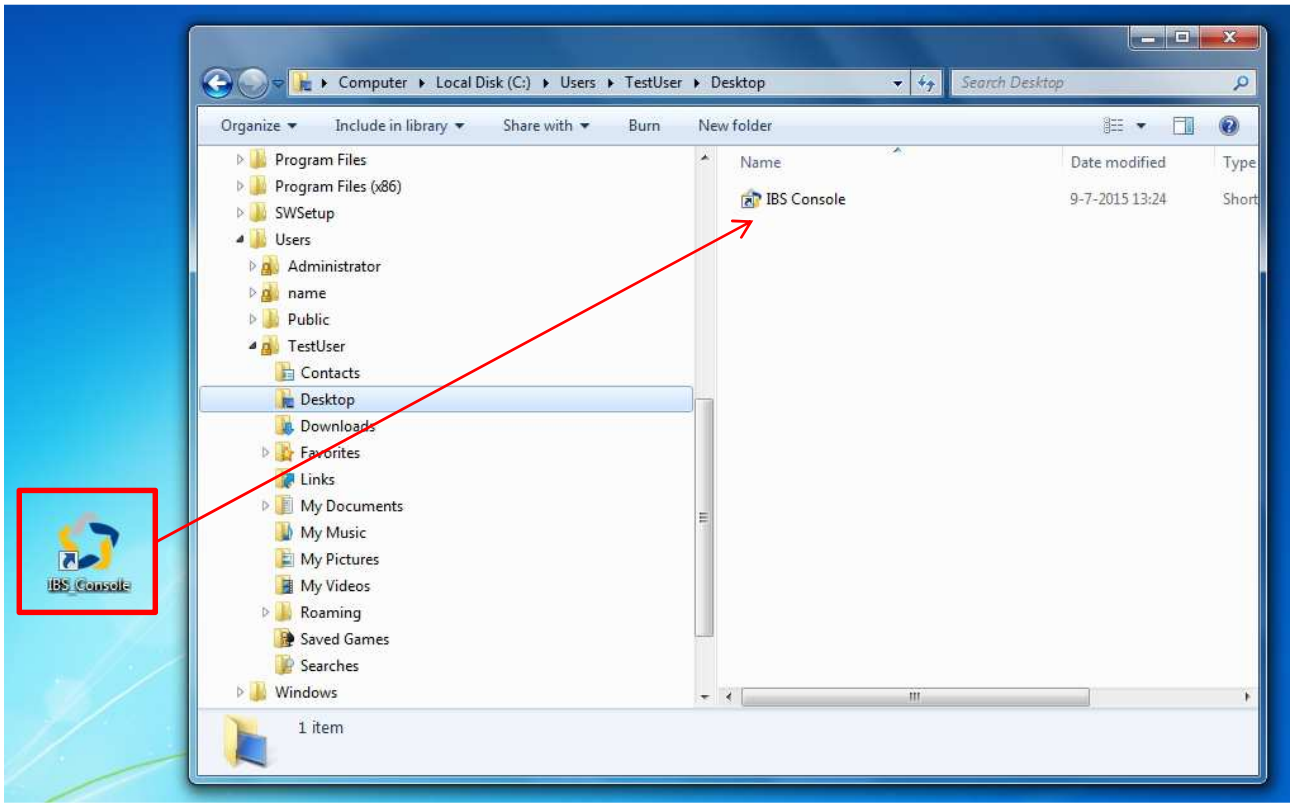


Figure G-21 Copy shortcut to user desktop

Copy the shortcut from the administrator desktop to the desktop of the standard user account. See Figure G-21.

To activate the shortcut, the administrator needs to switch from the administrator account to the user account by pressing "Start", the small arrow button at the right side of the "Shut down" button and select "Switch user" (Fig. G-22):

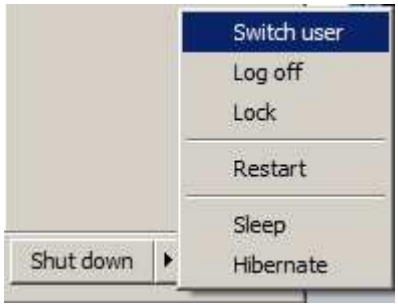


Figure G-22 Switch to User account

Run the shortcut from the user desktop; the following command prompt will appear:

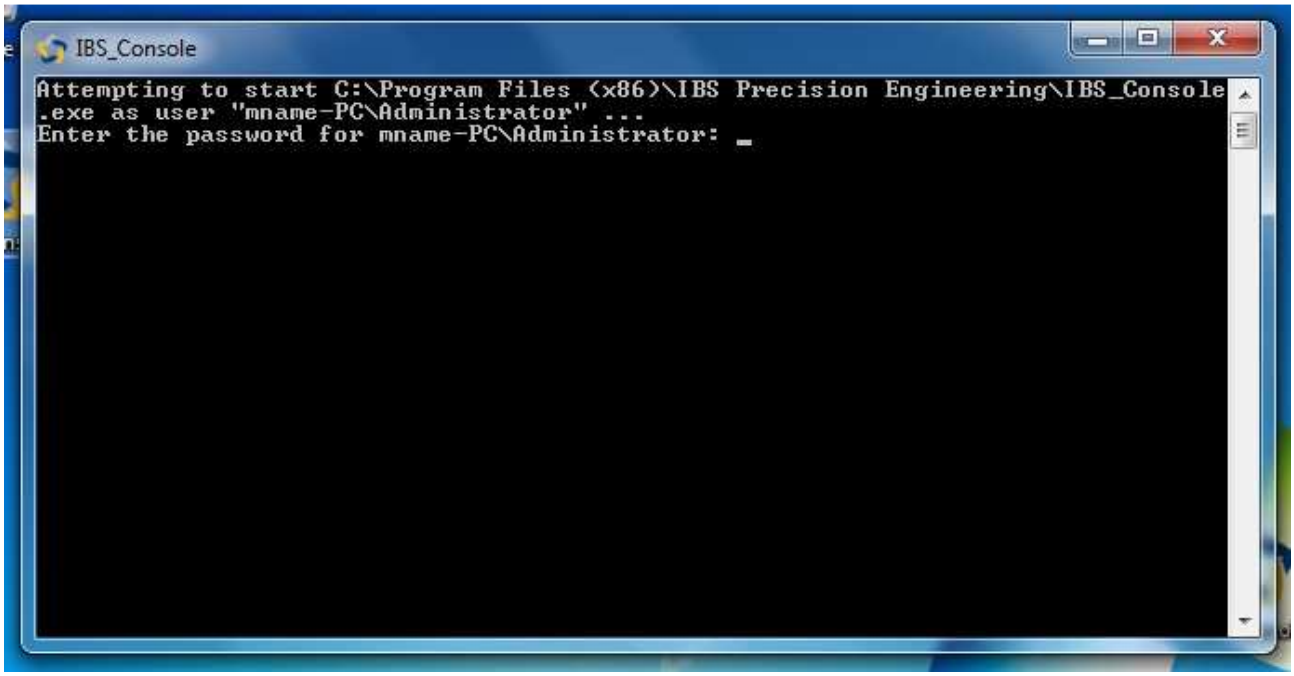


Figure G-23 Prompt shown on user account

Enter the administrator password (see section G-1) here once: the prompt will disappear and the application will start with no additional password requests.

Note: when entering the administrator password, the cursor in the command prompt will NOT move along: this is normal.

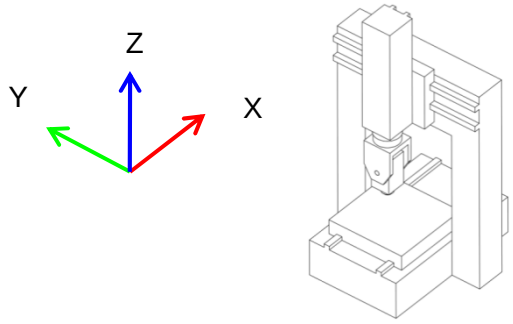
The next time the shortcut is run, the command prompt will show up very briefly, windows 'remembers' the credentials and will start the application with no further interference from the administrator.

Appendix H Machine types explained

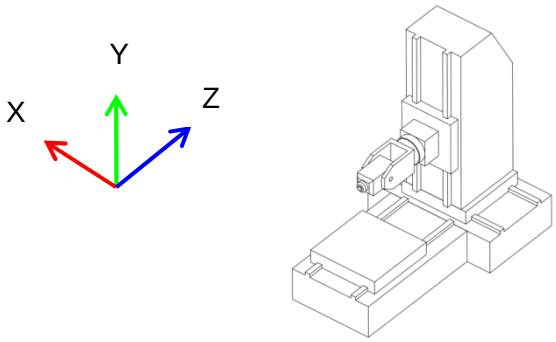
In the Console, 16 different machine tool configurations are implemented covering most existing machine types used in industry:

A. Swivel head machines (5 machine types)
B. Trunnion table machines (7 machine types)
C. Mixed type machines (4 machine types)

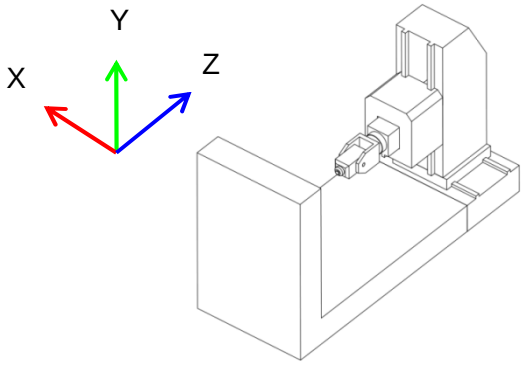
Overview swivel head machines



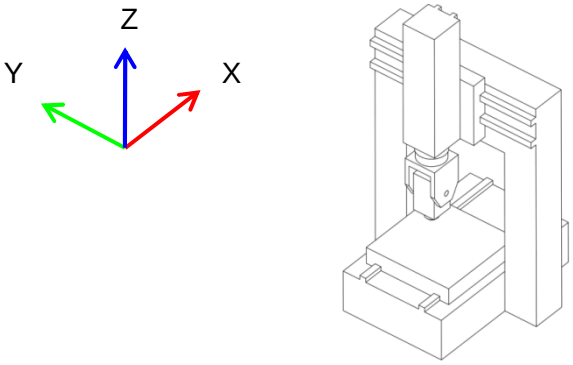
S_VS_HT_AC



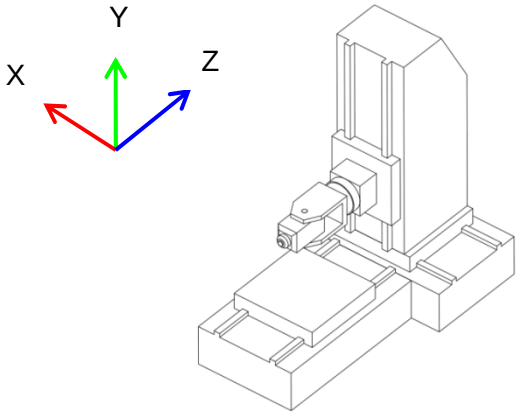
S_HS_HT_AC



S_HS_VT_AC

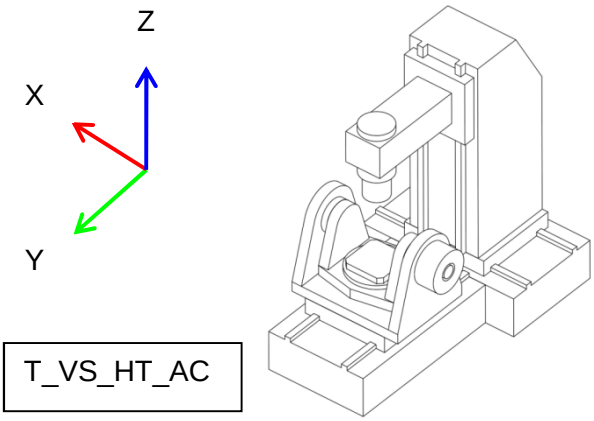


S_VS_HT_BC

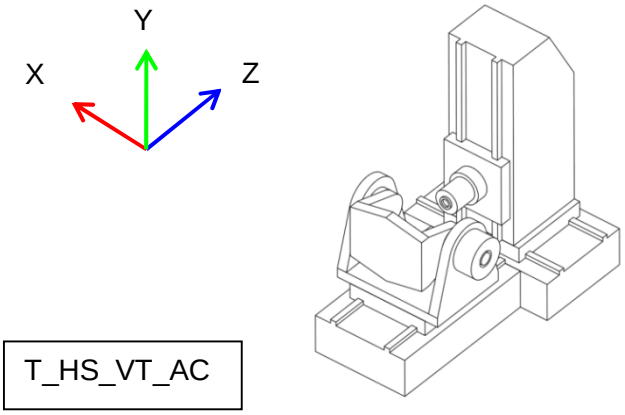


S_HS_HT_BC

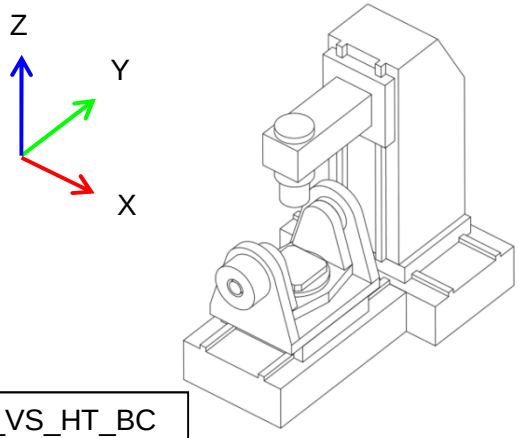
Overview trunnion table machines



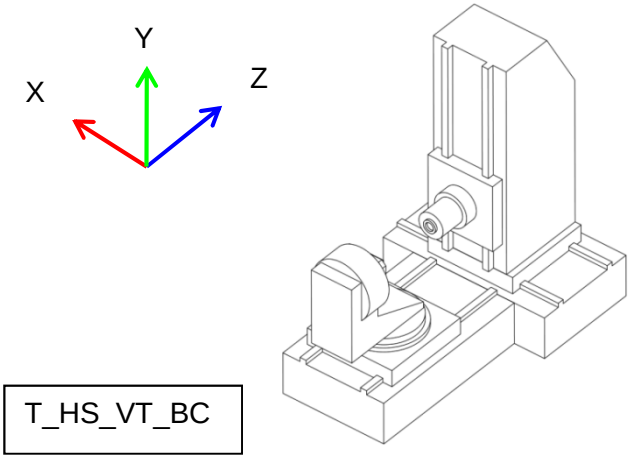
T_VS_HT_AC



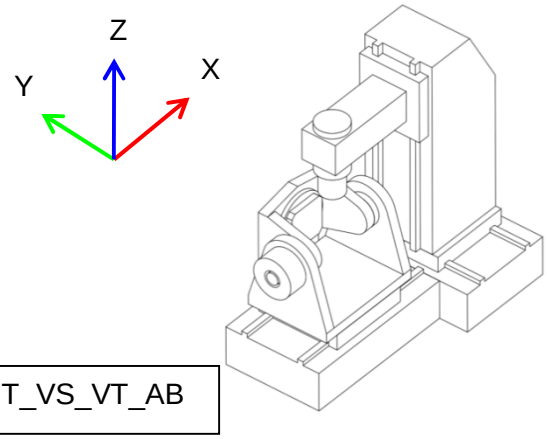
T_HS_VT_AC



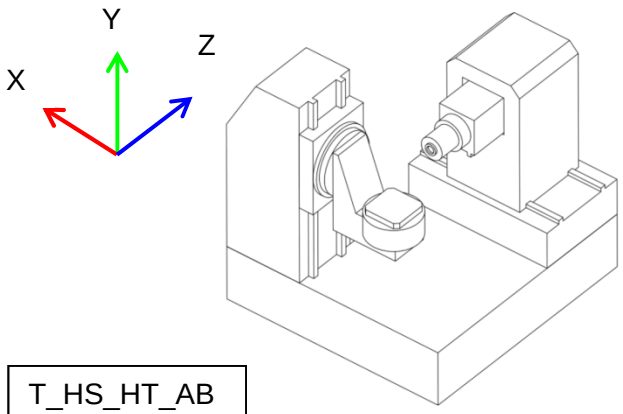
T_VS_HT_BC



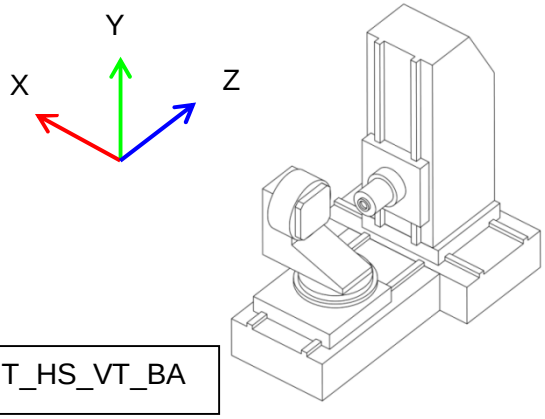
T_HS_VT_BC



T_VS_VT_AB

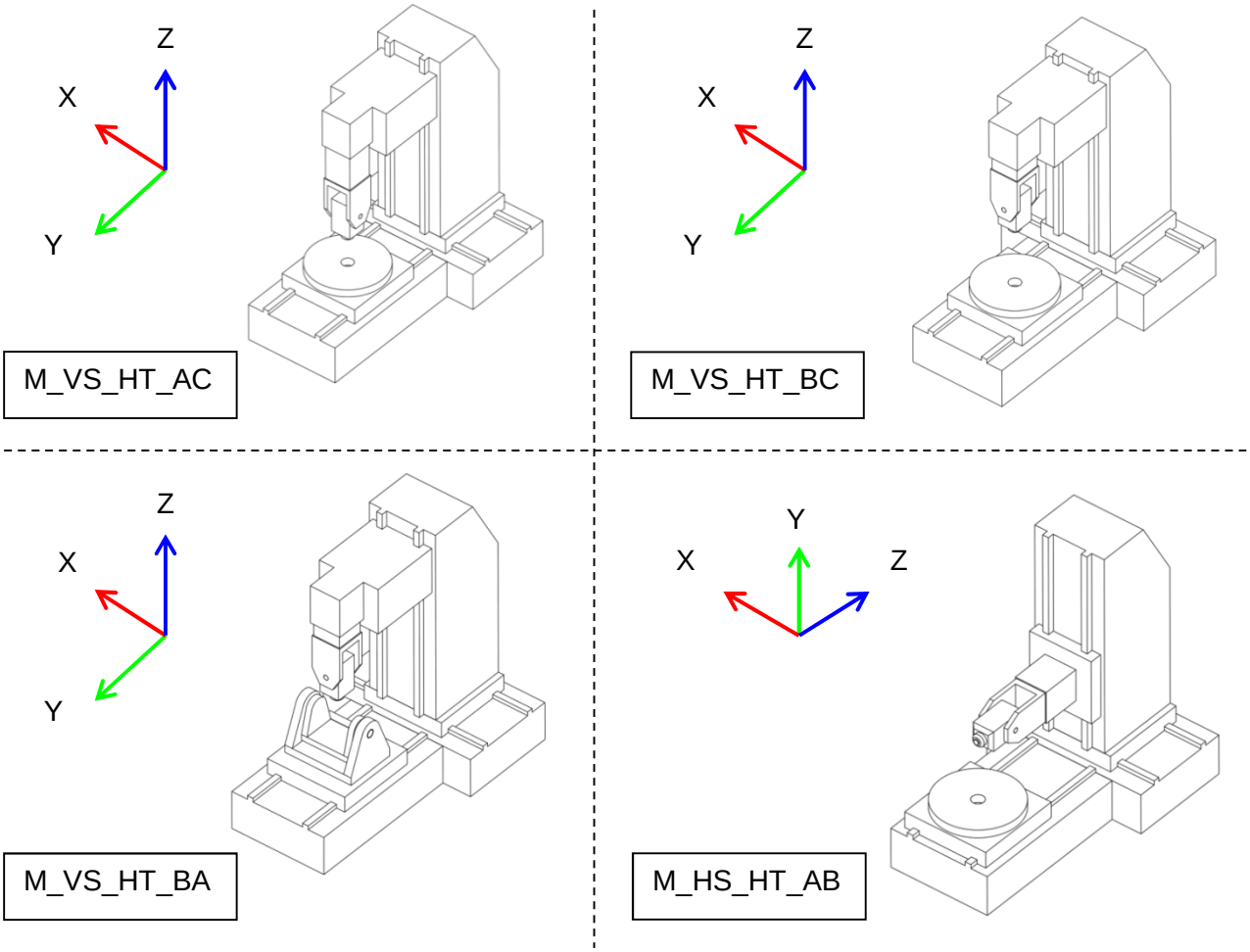


T_HS_HT_AB



T_HS_VT_BA

Overview mixed type machines



Explanation machine code name:
MachineType_SpindleOrientation_TableOrientation_RotaryAxes

Machine Type:	S (swivel head), T (Trunnion table) or M (Mixed type)
Spindle Orientation:	HS (Horizontal Spindle), VS (Vertical Spindle)
Table Orientation:	HT (Horizontal Table), VT (Vertical Table)
Rotary Axes:	AC, AB, BA or BC.

Appendix I EC Declaration of Conformity

Appendix J FCC Compliance Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution: To assure continued compliance, any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and
(2) This device must accept any interference received, including interference that may cause undesired operation.

Radiation Exposure Statement
This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

This equipment marketed in USA is restricted by firmware to only operate on 2.4 GHz channel 1-11.

Notes (intentionally left blank)

Notes (intentionally left blank)

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